

SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 71

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1949

ONE SHILLING

In this Issue

The New President
Britain's Energy : A New Conception
Power Resources and Power Utilization
New " Smokeless Homes " Feature
The Price of Success



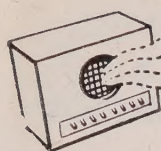
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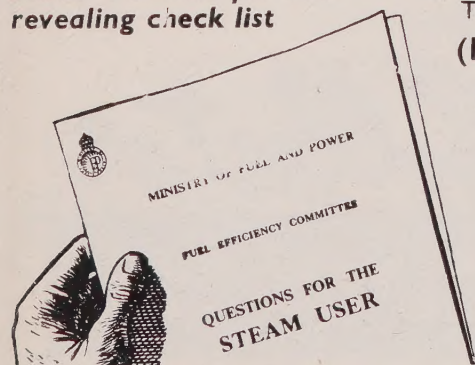
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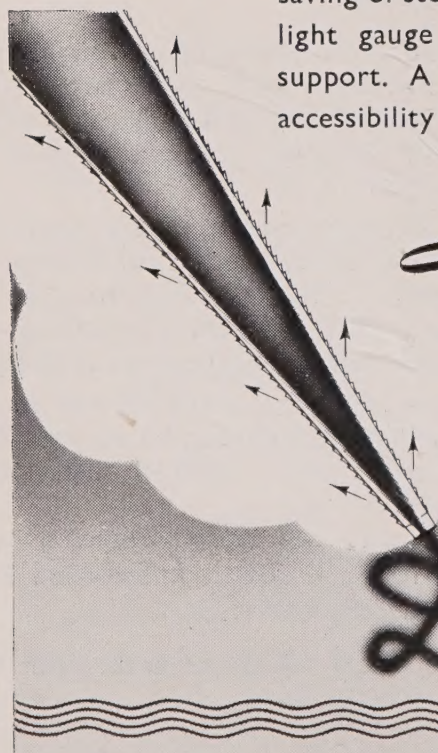
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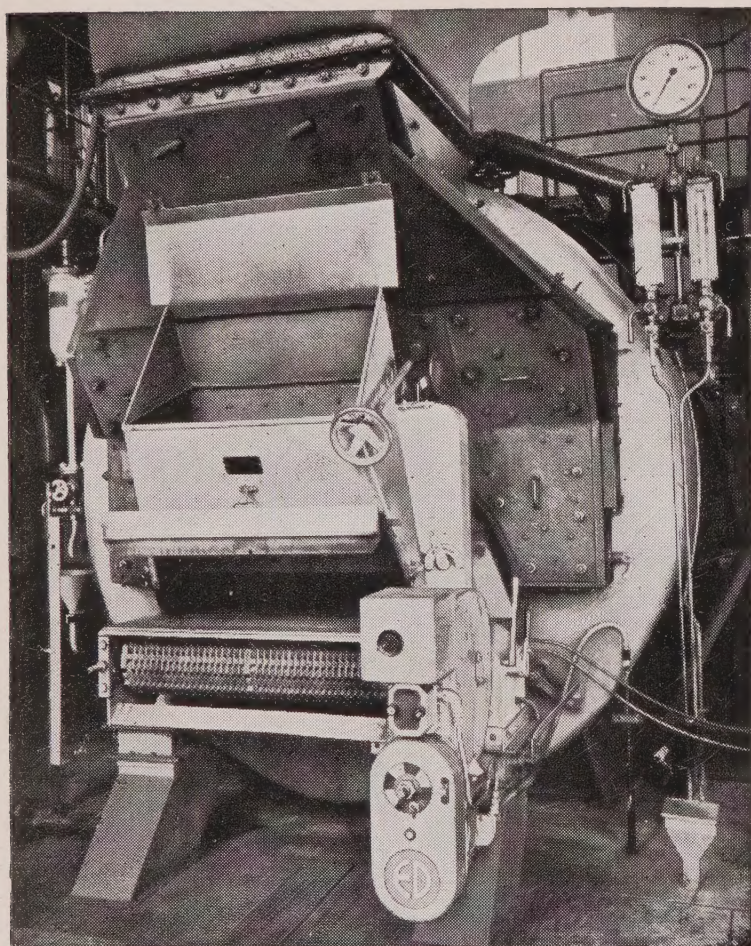
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SMOKELESS AIR

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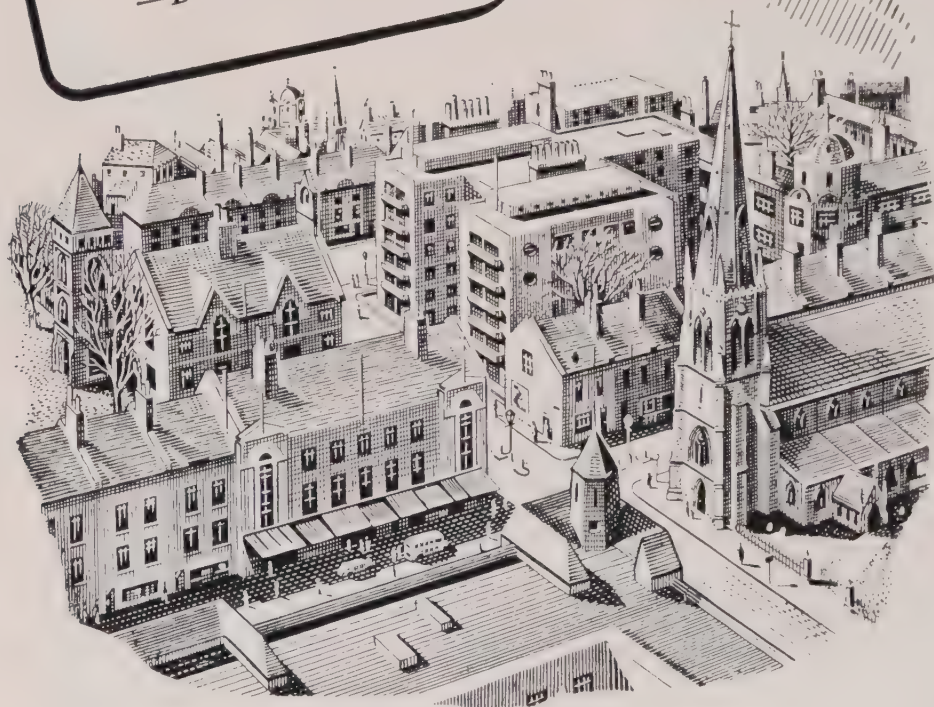
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

The Price of Success

SINCE the war the Society has grown substantially in membership and income, in the range and scale of its work, and in influence. It has become much better known and is no longer regarded, as it once was, as a "crank" society. Its opinions carry weight, and its advice is sought more and more. The policies it has advocated are making good progress and have been accepted in responsible quarters. Its publicity, though still very limited in volume, has had excellent results. It now has five Divisional Councils working in the

northern half of the country as well as its London headquarters office.

In short, the progress of the Society has been remarkably good, and there is no doubt that it can be continued even more satisfactorily if advantage is taken of the many opportunities that are continually presenting themselves.

This success, however, has its price. The Society not only lacks the money needed for further growth, but unless it can make certain of more income in the immediate future it must, for the first

time in its existence, begin to restrict even its present limited activities.

This is the position. The Society's income has risen materially since 1943 and 1944, when the present phase of its work began. In 1938-9 our total income was £1,400, the peak of ten years' steady growth. In 1943-44, after a wartime drop, the income was £1,100. For the financial year just ended (June 30th, 1949), the total was approximately £4,231. That is all in the right direction, but expenses have mounted faster than income, and in this last year a deficiency of over £700 has had to be met by drawing on our small reserves, which now total less than £2,000. Clearly this state of affairs cannot continue and one or both of two lines of action must be taken—to secure more annual income or to cut down expenditure.

Expenses have risen partly because of the increased costs of today, and partly because more activities are in progress. If we examine the possibilities of cutting costs we shall find that little can be done except by drastically pruning activities.

And that might mean a progressive decline, and finally the end of the Society. One of the difficulties is that since the Society has become so much better known the demands made upon it for information, advice, and various kinds of service and co-operation—usually without any recompense—have increased so much that many of the things that might be done have to be foregone. The work of the small headquarters staff involves a constant effort to keep up with all demands, and to keep each branch of its work in adequate order. Even so, much has to be left undone, and much more is done less effectively than is desired. Quite apart therefore from any schemes for needed new development, more staff and more office accommodation are needed to deal efficiently with the existing situation.

The amount of good work accomplished by the Society in comparison with the funds at its disposal has frequently been commented upon, and this in itself is confirmation that little

can be done to cut expenses without jeopardising the future.

Turning now to the more desirable alternative, that of increasing the annual income, we see at once that compared with any other work of equal importance what we need is extremely modest. Perhaps part of the trouble is that it is too modest. Another £2,000 a year would solve the immediate problem of continuing, more securely and with rather more efficiency, on our present basis. Another £5,000 a year would make possible some of the developments that are urgently called for.

Why, it may (and should) be asked, is it so difficult for the Society to get the funds it needs? Why cannot a few thousands be found for work that will help to bring about savings of millions? The problem can be analysed, but there are many factors, and it would need a lengthy article to discuss it properly. One of the root difficulties is, however, that smoke is so diffuse a problem, touching so many interests that have little else in common, that there is no one who can regard it as his own especial concern. It affects many, but has a low priority for all. There is much sympathy and approval, but subscriptions have tended always to be merely nominal.

We believe that the fuel industries should support us much more than they do, that more local authorities should come in and help and should subscribe more realistically, and that individual members should be numbered by the thousand instead of by the hundred. Again, the Society's appeal does not "pull" among the public because our objective is more distant than those of others who appeal to them, and because it isn't easy to stir up the emotions, the key to generosity, with smoke abatement.

However, a new appeal, to which this article is a foreword, is being planned, and we are confident that the Society will succeed not only in preventing a recession, but in going ahead even more vigorously than before.

The Future of Fuel

We are pleased to be able to include, side by side in this issue, reports on two recent papers, by Sir Claude Gibb and Professor F. E. Simon, each of which has an important bearing on the long-term policy for fuel and thus for smoke prevention. Although they approach the same problem from very different starting-points, and although Professor Simon's thermodynamic efficiencies may at first seem rather startling, it will be seen that the papers are essentially in harmony. Especially in their condemnation of the open fire are they at one, and such weighty scientific judgments should have all the publicity that can be given to them. As Professor Simon discreetly says, there has been quite a lot of discussion on this matter.

More bluntly, there is quite a lot of nonsense talked by woolly traditionalists, one choice example of which is given by Professor Simon. Another bright gem, based on no explained reasoning, came from the recent Royal Sanitary Institute congress, where a speaker argued that the high divorce rate in America was due to central heating, which by making the whole house warm, made it unnecessary for the family to huddle round the coal fire, as in Britain. It would be interesting to know whether the divorce rate is conspicuously lower in the many homes in America that are without central heating, whether it is higher in all other countries that do not indulge in coal-fire huddling, and whether the far from negligible number of divorces in Britain are due to our English summers . . .

New Legislation

We were sorry to read that the reply of the Minister of Health to a question in the House was that "in the main" the legal powers for smoke abatement were adequate, and that the chief difficulties were practical ones. It is only within the very limited framework of their own particular kind of legislation that the present powers can be said to be adequate and cannot be materially improved. The position today, how-

ever, is that a radically new framework has been found to be necessary, in which the old "stable door" conception of abating smoke by imposing penalties after it has been emitted is replaced by positive smoke prevention—the prevention of the conditions which may result in smoke from coming into existence at all. Prior approval, smokeless zones, control of fuel sales—these are methods that (except for the few new local Acts) do not enter into our now obsolete legislation of the 1875 era. If the Minister's advisers would carefully study the new American legislation (a further example of which is reported on another page) they would see what kind of advances could, and in our opinion, should, be made in this country. We should also like British industrialists to study this legislation and observe how their counterparts in the U.S.A. are co-operating in its formulation and are willingly accepting controls of a kind that our own Federation of British Industries and National Union of Manufacturers will not even discuss.

Smokeless Zones for Edinburgh?

Much publicity has been given to the Abercrombie report for the planning of a new Edinburgh, which, above all cities, deserves to be freed from the smoke that at present so badly disfigures it. More immediate steps to improve the atmosphere have recently been made by Mr. Allan Ritchie, the Chief Sanitary Inspector, in a report to the City Council. Mr. Ritchie makes a number of practical suggestions, including the installation of new type fireplaces in all new houses, replacement of old fireplaces, encouragement of the use of smokeless fuels, adoption of District Heating in suitable new housing schemes, encouragement of mechanical firing, the adoption of smokeless methods in all Corporation undertakings, an approach to British Railways about the serious railway smoke problem; and, above all, there is a recommendation that smokeless zones should be set up, starting with the central area—Princes Street, George Street, Queen Street and vicinity—and gradually extending outwards.

The New President

MEMBERS will be aware that Dame Vera Laughton Mathews has been nominated on behalf of the Executive Council as President in succession to Lord Simon of Wythenshawe. As no other nomination for this office has been received, her election will be formally announced at the Annual General Meeting in Harrogate on September 28th.

The Society is most fortunate in having Dame Vera as its first woman President. Her distinguished Directorship of the Women's Royal Naval Service during the war, and now her position as Chairman of the Domestic Coal Consumers' Council set up by the Ministry of Fuel and Power, indicate how much the Society is honoured by her kind acceptance of our invitation.

Many members will have the pleasure of meeting Dame Vera at Harrogate, when she will take over the Presidency from Lord Simon of Wythenshawe, and they may also look forward to hearing her Presidential Address at the 1950 Conference. For the many members who will not be attending the conferences, and who wish to learn more



about their President, we might suggest that they should read her delightful book of reminiscences, *Blue Tapestry*, in which she tells the story of the W.R.N.S.

Correspondence

Smoke on Snowdon

*The Editor,
Smokeless Air.*

Sir,

The dramatic photograph that appears in your summer number of a locomotive on the Snowdon Summit rack railway, belching forth a great sable plume of smoke, is certainly most effective as propaganda in the cause of coal smoke abatement, but no less so, I think, against the impropriety of allowing our mountains to be invaded by railways at all—whether smokeless or not.

Actually, however, my own smoke-

consciousness has just been acutely heightened by a long tour of the North West, with Manchester as centre, judging the *News Chronicle* "Loveliest Village of the North" competition. Any village that was relatively free from dinginess due to smoke and that had an atmosphere encouraging to flowers immediately gained marks that some others, not so favoured, could not recover through superior architecture, lay-out, or other amenities.

Clough Williams-Ellis.

*Plas Brondanw,
Penrhyndeudraeth.*

Britain's Energy—A New Conception*

By Sir Claude D. Gibb, D.Sc., M.E., F.R.S.

IS it too much to hope that there may yet arise a statesman, a scientist or an engineer, with sufficient vision, sufficient power, sufficient courage, to realize that no longer can Britain go on wasting that most precious of our few remaining assets—coal? Coal at present as for many centuries past, is regarded and treated as a fuel. Its average efficiency of utilization over the 200 million tons consumed annually in this country is only some 15 per cent. and it will remain at about that figure so long as we treat coal as a primary fuel.

When, however, coal is regarded as a chemical and is treated as such, we open up possibilities, the limits of which seem to expand with every consideration. And in this expanding sphere, where coal is a chemical, we see a continued great future for the steam turbine and bright prospects for the gas turbine.

Coal has been nationalized, the electricity supply industry also—so has transport and gas—and now is the moment to integrate these four great industries—all of them depending on our dwindling and most important national asset—coal. If we miss *this* chance of integration, it will never occur again—could not occur again.

It is almost certain that by looking at coal as a national asset, and regarding electricity, gas and transport as one national undertaking and not as individual industries, we could, in say twenty years, obtain the same amount of power, heat and light from about 120 million tons of coal as we now obtain from 200 million tons. To do so would require a huge amount of capital

expenditure which no one of the nationalized industries individually could justify, but which looked at as a long term national problem of the next fifty years is absolutely vital to the continuance of Great Britain as a Great Power. It is indeed likely that in less than fifty years we shall only be raising about 120 million tons of coal per year.

Despite the nonsense talked about atomic power generation, there is no evidence in sight that such generation will be economic or likely to compete with coal as our main source of energy for a great many years. It is true that atomic power generation *is* possible today, but *not* to give a surplus output of power over that required to produce the fissile material and to re-treat it for further use. If and when new metals are discovered having the special properties demanded by the atomic pile, then the problem will be somewhat simplified, but the economics of atomic power generation are almost certain to prove once again that “You can’t get owt for nowt.”

The closest study of the future of energy generation drives one back to reconsider the coal utilization problem—makes one realize just how important it is that we cease wasting coal and coal by-products.

We can all remember the years 1930 to 1938 when posters covered the hoardings reading “USE MORE COAL”—when the coal industry established research and publicity organizations in an endeavour to increase the sale and use of coal. Even today there is competition between electricity and gas in the domestic and industrial heating fields—and they both compete with coal coke and oil fuel. But should they? In at least nine cases out of ten the answer should be an emphatic “No.”

* Parts of the Watt Anniversary Lecture, 1949, delivered before the Greenock Philosophical Society, 19th January 1949.

Electricity

Who will say that in the supply of rotary power and in lighting there is anything comparable with electricity in efficiency, cost, cleanliness and low maintenance?

But is it realized that a one kilowatt domestic electric radiator costing, say, one pound to purchase and install, costs the nation one hundred pounds to supply if it is used during a peak load period? That hundred pounds is made up by the present day costs of a large central power station, which are approximately £50 per kw. of load delivered, plus an almost equal sum in transmission and distribution costs. It is of little avail to ask consumers not to switch on that radiator during peak load periods—if the radiator exists and the room or occupier is cold, the switch will go on. Despite everything—we still are all human. But if the radiator used gas over the peak period, the effect would have been far less serious because gas can be stored and the gas making plant does not have to be designed and built to deal with short time peak loads but with average loads over a day or two.

It is in this fundamental difference between gas and electricity—the ability to store the one and not the other—that we receive a clue to a national fuel policy.

To build sufficient electric power stations so that radiator load could be supplied during peak load periods would be extravagant and would not give a return on the capital employed. Hence, other users of electricity would, in effect, have to subsidise the radiators used over peak load periods. This attack on the open bar type electric radiator does not mean that off peak or night electric hot water storage heating is to be discouraged. Quite the reverse—night storage heating for background temperatures should be encouraged to the maximum with the open radiator banned during periods of exceptional peak load.

The solution is to use electricity where it is the most efficient and economic form of energy and to use gas



Sir Claude D. Gibb

where gas is supreme, and that is mainly in industrial and domestic heating.

Coke

You will observe that coal, coke or fuel oil are not mentioned as direct sources of industrial or domestic energy, whether for lighting, heating or power. It is my belief that although something may be made of the storage argument, there is no place for those fuels in the future except in special and isolated cases.

Coke is essential in the production of iron from crude ore, and in the subsequent refining or casting, but, in general few if any, would use coal, coke or oil in domestic or industrial heating if supplies of gas were plentiful and at a cost per unit of useful heat equal to them. In other words, if gas and electricity were plentiful and cost no more than solid or liquid fuels—few, if any, people would want to use anything else.

Can, therefore, electricity and gas be made available at a price capable of replacing all other forms of energy? I believe not only that the answer is yes, but that we must use every endeavour

to achieve that ideal in the long term national interests.

Coal as a major fuel in the production of electricity is not likely to be reduced in cost, but probably the reverse. Capital charges for new power stations are already from $2\frac{1}{2}$ to 3 times those pre-war, and, again, are not likely to be reduced. One important way by which electricity cost can be reduced, is to produce a greater number of electrical units per annum for a given capital investment. Similarly, transmission line capital charges can only be reduced by carrying a larger number of units per annum. Hence, one way of reducing electricity cost to the consumer is by a marked increase in the overall load factor of generation and distribution. Another way is by the further adoption of thermal electric stations and district heating.

On our railways, the average efficiency of coal fired locomotives today is probably less than 6 per cent. By main line electrification, that average efficiency could be improved to about 20 per cent., and by careful scheduling of freight trains, running these mainly through the night, a marked increase in electrical base load, and therefore in load factor, could be achieved.

The cost of railway electrification today would probably be nearly 750 million pounds sterling, and such a figure at first sight appears frightening considered only as a transport capital charge. But, regarded as a national problem and not as a transport industry problem, it becomes more attractive.

This is still assuming that raw coal is the fuel used for electricity generation. This, however, need not be the case, and, indeed, must not continue to be the case.

Underground Gasification

Experiments in America, Belgium and, we believe, in Russia, have shown the underground gasification of coal to have distinct possibilities, and it may well be that the shortage of man power and the difficulties and cost of coal winning will force underground gasification on the Coal Industry at an accelerating rate. It is not, however,

necessary to await the successful development of underground gasification, with its attendant control difficulties, to achieve startling economies in coal utilization.

The majority of the coking coals raised in Great Britain are already carbonized in coke ovens or gas works, and yet there is a national shortage of the gas and coke resulting from that carbonization. It is very evident that a great expansion of coal carbonization could be made and there would still be an immediate use for its gas, coke and the hundreds of by-products thus obtained. But the bulk of our coal available is of the house or steam type, and there is ample experience to show that these coals also can be processed, recovering the majority of their by-products and leaving a residue of semi-coke. One or other of the low temperature distillation systems would achieve that end with almost all our coals.

A study of our national economic situation indicates that unless something radical is done, we are always going to have an adverse balance of trade and that we shall in the future find it increasingly difficult to pay for the imports of our food and raw materials and of the oils and petrols which our present road transport demands for its operation. Let us face the facts about our balance of trade in the future and take immediate steps to improve it.

Coal Hydrogenation

Hydrogenation of coal could, in say twenty years, make us almost entirely independent of imported oils or petrols, but the capital cost would be very high. One of the by-products of high and low temperature distillation likely to be a large surplus of such processing, would be creosote, and this is an ideal compound for subsequent hydrogenation. If our distillation processes are adjusted so that the maximum yield is obtained of those by-products in greatest demand, the national economic picture would be so greatly changed as to make me believe the huge capital expenditure would be fully justified.

The semi-coke residue from low temperature distillation is an ideal fuel

for an orthodox chain grate, stoker-fired, steam boiler or for pulverized firing, and there appears to be no reason why an enhanced base electrical load could not ultimately be generated entirely from the consumption of this semi-coke residue.

According to the distillation system adopted and the type of coal being processed, the gas delivered will vary widely in quantity and calorific value. It may be as low as 200 B.Th.U's per cubic foot or as high as 1,000 B.Th.U's. Should it be of the lower value, a relatively simple process will enrich it if required, but there is no difficulty in utilizing it at its value as produced. If it has a thermal value above 500 B.Th.U's, it can be used to enrich the gas from orthodox gas producing plants and used domestically and industrially.

It is my belief that the large gas turbine will come into its own, only when it does not compete with the steam turbine as to the type of fuel it can use, that is to say when it is truly a gas turbine and not while its fuel is solid or liquid. Gas, having a calorific value even below 100 B.Th.U's. per cubic foot—such as cleaned blast furnace gas—is an ideal fuel for the gas turbine and in the steel industry and using blast furnace gas, there is a field for it today.

By operating the distillation processes at a reasonably constant load, although adjusted seasonally, they will achieve maximum efficiency and provide a relatively small storage problem for the semi-coke residue. A storage problem is created for the gas, but this could be solved by high pressure gas storage and then the gas turbine, true to its name, can be used ideally for dealing with peak electrical loads—which have already been reduced in magnitude by railway electrification and by the replacement of domestic electric radiators with gas heating systems or off peak electric thermal storage.

The Need for Exports

Coal processing, with its by-products providing the needs of a virile and

expanding chemical industry, can provide the nation with desperately needed exports of a value far exceeding the value of any exportable surplus of raw coal. As a nation we must realize that our whole future depends on our ability to export manufactured goods of a type and quality not readily available in the world markets remaining open to us. In this field, and to an increasing degree, fall chemicals made available by the processing of coal. We must cease to export *raw* coal and instead process *all* our coal, and sell abroad coke, semi-coke (if there is any to spare), and the chemical by-products of our processing at a greatly increased total export value.

You may well ask what fuel is to be used in the millions of homes already existing and only possessing open coal fires? The answer is semi-coke, which will light as readily as household coal and will burn with a smokeless fire radiating a greater proportion of heat. But we must at once make up our minds that the centuries-old British tradition of the open coal fire is a tradition, like many others, that we can no longer afford.

By the time the overall "coal as a chemical" plan is really becoming an accomplished fact, many—if not the majority—of our existing houses will be in need of major reconstruction or even rebuilding. If all our new houses make provision for heating at optimum efficiency, the existing houses will soon begin to arrange modifications to take advantage of cleaner, more readily available, labour-saving methods of keeping warm. People on the continent of Europe or in Canada and America do not miss the open coal fire. They may think it nice as a novelty, but their wives who have to do the cleaning would not change their central heating for open fires. The children of Britain today do not miss bananas seriously, because they have not known them as a part of their diet. The second and third generation from now in Britain will not prefer open coal fires but rather will wonder why we retained them for so long.

A New Feature

SMOKELESS HOMES

By Way of Introduction

SMOKELESS AIR tries to cover all aspects of the smoke problem, and tries to be of interest to all its readers. This is not easy, because there are so many aspects, and because its readers range from the fuel technologist to the medical man, from smoke inspector to housewife, from business man to student, from town councillor to scientist. So much material is available these days that the magazine could be made four times the size (and would be if we could afford it) so that it is only too easy, in cutting and condensing, to fail to give sufficient space to what is after all one of our biggest problems—that of the smoke of our home fires. This, from an editorial viewpoint is quite wrong, because *all* our readers are interested in homes. So in future each issue is to have a “Smokeless Homes” section, in which will be given news and comment on domestic matters, especially fuels, appliances, and house construction. We are carefully avoiding saying that this is to be “mainly for women,” although it may become the section of most interest to many women readers, and may even acquire in time a slightly more feminine touch. . . .

The Open Fire Hazard

The recently published review of the causes of burns, analysed by the Birmingham Accident Hospital, shows that 70 per cent. of all burns occur in the home, and that the open coal fire is “still the outstanding hazard of the English home.” This does not make another reason for abolishing the open coal fire, but it does suggest that the protection of young children against this danger needs some drastic revision, and the report proposes (1) improvement in the design of guards for open fires and proper provision for fixing them in all new houses built by local authorities,

and (2) regulations requiring that all electric and gas fires offered for sale must conform to certain standards.

The fixing of fireguards, especially in front of fires in the modern tiled hearths, is a difficult and generally insoluble problem, and a badly fixed guard by giving a false feeling of security, may be a source of danger in itself. Would not it be possible to design all modern (“approved list”) open fires so that a specially designed guard could be quickly and securely fixed to them? The method could perhaps be standardized, so that the same guard would fit any make of fire, to which it could be attached or clipped irrespective of the nature and design of the hearth and surround. We commend the suggestion to the makers of these appliances.

Smokeless Fuels

Service in Birmingham

The Birmingham Co-operative Society provides every type of solid smokeless fuel in general use, and as switching over to these fuels provides many problems for customers, the staff of their new fuel office, recently opened in Moor Street, is providing a comprehensive advisory service. A display cabinet, exhibiting the various kinds of fuel available, has been placed in the office and a separate room has been provided where customers can talk over their problems in private.

The staff, it is said, will emphasize the desirability of using smokeless fuel in bungalows and pre-fabs in order to avoid belching forth smoke close to the ground. It has also been noticed that many of the new registrations are for fuel supply to houses equipped with new central heating systems in which it is important smokeless fuels should be burnt.

We congratulate the Birmingham Co-operative Society on its enterprise in

taking practical steps to encourage the wider use of smokeless fuels, by means of what is, as far as we know, a pioneer service. We hope it will be followed by fuel merchants in every town. Not only does it help customers in a way that experience has shown to be necessary, but it is a practical form of co-operating in the smoke abatement movement, and, moreover, is one of the things that will help the fuel merchants to meet the revolution in domestic heating habits that, though not yet generally realized, is now in progress.

Experiment at Stanmore

Birmingham seems to be taking pride of place in these notes, for it is also the headquarters of Radiation, Ltd., who are responsible for important experiments in house heating now being carried out at Stanmore in Middlesex. Here a pair of semi-detached houses have been built for extended trials of "whole house" heating by forced warm air. The ground floor of each house, apart from the kitchen, consists of a single living space, comfortably heated at all times (or cooled by forced air circulation in summer). The resulting effect is one of spaciousness and light.



The Gas Chimney Furnace in the first Stanmore house



The solid fuel Cabinet Heater in the kitchen of the second house at Stanmore

Upstairs, although the bedrooms and bathroom are divided off, the provision of complete house heating throughout all the living space enables even the bedrooms to be available for occupation with comfort at any time, and no longer is it necessary for the whole family to congregate round the living-room fire on a cold winter's evening. The elimination of cold areas and freedom from draughts has made it possible to include the staircase as part of the living-room, so increasing the useful space. The kitchen equipment is all built-in *en suite*.

The Heating System

In one of the houses the heating unit is a new gas chimney furnace, an appliance which includes a gas burner with pilot and safety flame-failure device, a heat exchange unit of heat resisting steel, electric fan for force circulation of warmed air to rooms, room thermostat, and air filter. One of the accompanying photographs shows the position of the furnace by the corner of the stairs in the living room, with the registers

(Concluded, page 18)

SMOKE CONTROL IN ALLEGHENY COUNTY

Surrounding the city of Pittsburgh is Allegheny County, one of the world's greatest centres for steel and general industrial manufacture. This article describes its comprehensive new smoke ordinance.

THE city of Pittsburgh has in force an effective smoke ordinance, the effects of which were described in the Autumn-Winter issue of *SMOKELESS AIR* for 1948 by Arnold E. Reif. The surrounding territory of the County of Allegheny, containing a large part of the iron and steel industry of the U.S.A. had at that time taken no similar action to deal with the pollution of its atmosphere.

Following a petition by 48,000 people, an ordinance has now been enacted to deal with this problem, which was discussed by Thomas C. Wurts, the Engineer-in-Chief, Smoke Control Bureau, Allegheny County, in a paper given on May 23rd, 1949, before the Smoke Prevention Association of America.

The County of Allegheny, excluding the city of Pittsburgh, has an area of 700 square miles—about that of Surrey—and a population of 750,000. It contains 29 blast furnaces, 132 open hearth furnaces, many puddling furnaces and Bessemer converters, a number of cement works, 2 large by-product coke oven plants and many large industrial undertakings. Its extensive coal-mining industry is responsible for several hundred spoil-banks, more than 50 of which are on fire. The County consumes some 50 million tons of coal a year, of which, owing to the availability of large quantities of natural gas, only about one million tons is used for domestic heating.

The ordinance established an ad-hoc authority, the Bureau of Smoke Control, and made it an offence for any fuel-burning plant to emit smoke; determined fines to be imposed in respect of offences committed; and fixed fees for

the examination of plans of fuel-burning plant proposed to be erected, for issuing of permits and certificates of compliance and for issuing licences for dealers in solid fuel. The Bureau is not expected to be self-supporting, and it is estimated that its income from fees and fines will not exceed some 15 per cent. of the expenditure and might reasonably fall further as the work of the Bureau became effective. The remainder of the cost would be met from County funds.

Prior Approval

The ordinance provides that no person shall construct, install, or alter any industrial fuel-burning plant until he has filed in duplicate an application with the Bureau of Smoke Control, which application shall be approved or rejected within ten days, and if approved, an operation permit shall be issued. Hand-fired equipment will not be approved. If the work in respect of which the permit is issued is not begun and diligently pursued within one year, the permit becomes void.

The ordinance covers the erection and operation of all fuel-burning plants, industrial and domestic, but it embodies special reservations regarding certain industries, railway locomotives, electric power stations, steel industry, coke ovens, sintering, cement manufacture, incinerators, spoil banks and river tugs.

The production or emission of dense smoke is prohibited and no person shall cause or permit smoke darker than No. 2 of the Ringelmann scale, except in cases of a breakdown of plant, or when smoke is not reasonably preventable. The offender is required to report the occurrence of such an incident in writing to the Bureau and the date on which it is anticipated the fault will be rectified.

After three or more offences, a notice is served on the offender, giving him ten days, after which he is to appear before the Director of the Bureau to show cause why the plant shall not be sealed.

The approval of plans and specifications and the issue of an operating permit for the plant does not exempt the owner of a plant who commits an offence, from liability for the penalties imposed under the ordinance. All prosecutions are to be brought in the name of the State of Pennsylvania before an alderman or Justice of the Peace of the County.

If the Director is of the opinion that a fuel-burning plant is not a proper installation under the ordinance, he may elect, before a prosecution is made and after giving notice to the proprietor, to carry out tests. Tests must be carried out by a professional engineer and the results made available to both parties.

Fuel Sales Control

All dealers in solid fuel are required to be licensed, and are permitted to supply for hand-fired equipment only such fuels as are specified for that purpose. All fuel supplied is required to be accompanied by a certificate giving the volatile content on a dry basis within 2 per cent.

It is of interest to note that the formulation of the ordinance was the work of a committee consisting of seventeen members representing very diverse points of view, such as the steel industry and other large industries, railways, mining, trade unions, the Civic Club of Pittsburgh, women's clubs, etc. Special sub-committees were set up to represent the iron and steel industry, railways, power and heating plants, and other special industries. Representatives of these very diverse interests showed a very "helpful and a very co-operative spirit and very little tendency to follow selfish lines of argument."

The smoke abatement movement has had and still has the support of a number of local committees, the conference of Community Development, the Smoke Abatement Advisory Committee and its

technical sub-committees, and the whole-hearted support of industry.

The smoke control ordinance empowers the County to "abate" smoke, but does not include within its purview the suppression of other forms of atmospheric pollution. A favourable public opinion has, however, permitted a liberal interpretation of "smoke."

The spirit that has dominated the proceedings has been expressed by a member of one of the sub-committees as the formulation of the best possible ordinance, keeping in view the objective, the suppression of smoke, avoiding all unnecessary restrictions, and allowing the greatest possible freedom of choice, while avoiding any restrictions selfish to any industry or group of industries.

Smokeless Homes—*concluded*

emitting hot air to the right. Air is drawn by fans from the landing down through the heater and directed to each room—including the bedrooms—being discharged at floor level in each case.

In the second house of the pair the heating unit is an interesting new solid fuel cabinet heater, which is installed in the kitchen. It consists of a solid fuel down-draught furnace, heat exchanger to extract the heat from the flue gases before they pass into the chimney, a 45 gallon hot water cylinder, and a fan and air filter unit to circulate clean, warm air for space heating. There is also a gas-heated circulator for thermostatically controlled summer water heating.

This furnace burns any solid fuel, and needs recharging once to four times each 24 hours according to the kind of fuel used. Its design means that even bituminous coal can be used with very little smoke emission.

We hope to give a further account of this experiment in a later issue, with reports of the extensive tests that have been carried out in the houses. In the meantime readers may read more details by applying to Radiation Ltd., 7 and 8 Stratford Place, London, W.1., for a copy of their illustrated booklet "House Warming."

Power Sources and Power Utilization

From a Paper* by F. E. Simon, C.B.E., Ph.D., F.R.S.

(Professor of Thermodynamics, University of Oxford)

PROFESSOR Simon, in this most important paper, first discusses the efficiency with which we use the power resources at our disposal. It is not easy to summarize this part of his paper in a way that will be clear to the layman, but his argument is roughly as follows. In a "fuel plus oxygen of the air" system we have a store of free chemical energy, which in an "ideal" performance could be transformed into mechanical energy and the change reversed. That is the thermodynamical ideal which for many reasons it is difficult even to approach. In practice we first turn the chemical energy into the convenient but disordered and therefore lower, form of energy known as heat. In prime movers we then convert as much as possible of this heat into mechanical energy, but in doing so waste a very substantial proportion of it in the surroundings that are always at a lower temperature. But, asks the author, if we pay so much premium when the process is going this way, cannot we gain something when we do the opposite and turn mechanical energy into heat?

The answer is that with the heat pump we can; if we put mechanical energy into an ideal heat pump to raise temperatures by only a small amount (as in domestic heating) we could in fact deliver 15 times as much heat at the higher temperature level as is put into the system as free energy. The remaining 14 parts are of course not created but are taken up from the lower temperature level in the form of heat.

In practice we can obtain not a 15 times gain with a heat pump, but some-

thing in the order of 5 to 6 times. Even so, compared with processes in which we turn free chemical energy into heat, either for itself or to turn into mechanical energy, the efficiency is very good. On this thermodynamic basis, if we take the ideal heat pump as being 100 per cent. efficient, Professor Simon shows the efficiency of the electric fire, usually taken as 100, to be only 7 per cent. The efficiency of central heating becomes 5 per cent., the closed stove 3 per cent., and the open fire just 1 per cent.

"The heat pump," says the author, "can thus effect a big saving if one has to use electricity for heating. In Switzerland, which draws important amounts of its power from water, a number of public buildings are already heated by heat pumps. In our country, however, we have to produce our electrical energy from fuel, and in doing so waste about 4/5 of the power available. Thus the advantage in using an electrically driven heat pump over a good central heating system would only be small for us and not worth the more complicated machinery."

Other ways in which we misuse our fuel are considered. Light production in modern electric bulbs is about 6 per cent. efficient for a 40-watt lamp. The average efficiency of the locomotive is about 5 per cent. Motor cars go up to 20 per cent. And then: "One can calculate from the forces between the atoms how much work is really necessary, say, to sever a piece of steel into two parts. In the actual act of sawing a rod of steel into two pieces we use 100 million times as much energy as the thermodynamic minimum!"

"Now in order to avoid misunderstanding," continues Professor Simon,

* To the Royal Institution of Great Britain on November 19th, 1948.

"I do not suggest that one could really carry out these operations with $1/100$ millionth of the work now required; if such a factor is possible in principle, however, it is perhaps not asking too much to improve by a factor of 2 or even 10 in practice."

"... These examples are sufficient to show you the broad lines of my argument. If we average over all activities consuming energy we arrive at an efficiency of about 3-4 per cent. That means that of the 200 million tons of coal we use per year, over 190 million are run to waste, but of course not all this waste can be avoided."

Fuels

The paper then reviews the potential power sources, starting with coal, and going on to consider oil, water power, wind power, tidal power, the heat of the ocean, the direct use of the sun's radiation, and finally atomic power. Summing up, Professor Simon says: "We need not worry about the more distant future. Even with enormously increased power consumption there are enough potential sources of power which can be made to yield their supplies. The sun's energy and possibly atomic energy, will eventually be able to take over, but it would be irresponsible to count on either of these in the near future. Neither can any of the power sources which are already in practical use alleviate our short-term troubles."

"The only way out is for us to stop throwing away our power as lavishly as we do at the present time. As I have already shown we only utilize about $1/30$ of the power consumed. If I may use an analogy, it is as if, being unable to pour milk out of a jug without spilling it, I had to empty a gallon jug in order to fill a small glass. I have a shrewd suspicion that my family would not let me get away with this, particularly when we are short of milk. The analogy actually goes a bit further. If we do not use the power properly the rest has to go somewhere, either in the form of improperly utilized fuel, or smoke, which soil our towns and houses, or in the form of refuse which clogs up our machinery, or as heat which has

to be removed from the working machinery—this latter is very often a limiting factor in design. In addition to this, of course, we have to transport and distribute these unnecessary amounts of fuel and energy.

"Now in the case of power the saving could not be quite as easily effected as in my analogy, but a very great deal could be done, certainly enough to save the relatively small amounts of fuel of which we are short. As you know, 20 or even 10 million tons of coal per year would make all the difference to this country.

"The figure of 3 per cent. utilization refers to the thermodynamic optimum, that is, only to fully reversible processes. Now of course no one expects to get anywhere near this; actually a fully reversible world would be a nightmare. . . . Imagine that you had no brakes on your motor car and had to rely on some mechanism to collect the energy when you wanted to decelerate. This last example shows clearly that friction is not the unmitigated nuisance most people think. Without friction we could only move on cogwheels, for instance, and if I now dropped something it would go on bouncing for ever. On the other hand we should not forget that improvements in technical developments have practically always been coupled with an increase in reversibility. The invention of the wheel was the first step towards reversibility and its full benefits could not be made use of until the Romans developed the hard road; much later, further improvement in reversibility came with the iron rail. Most of the benefits which the supply of electrical power gives us are again due to the fact that its distribution is very nearly reversible.

"Where the optimum lies will depend on many factors, technical, economic and psychological. The human body strikes a balance at an overall efficiency of about 25 per cent. In power utilization we can—by applying present knowledge only—increase our 3-4 per cent. utilization to roughly 10 per cent. I will mention a few items, the most



Professor F. E. Simon

important being in the field of heating and insulation of our houses. How coal itself should best be used is a rather complicated matter as we have to consider coke and gas also and the fact that coal is a source of valuable chemicals. But it is clear that we have to abandon the open fireplace—about which more a little later on—and irreversible electrical heating. The heat pump is not a very attractive proposition under our conditions but a system based on the same principle—and in practice even more efficient—namely, the use of ‘back-pressure’ turbines in power stations, with utilization of the ‘off steam’ for district heating, should certainly be considered wherever permitted by the geographical conditions. Heat pumps in industry could save something, as could the electrification of our railways. In the home a number of small items, such as the use of fluorescent lighting or pressure cookers would add up to a quite appreciable saving. The extended use of plastics and powder metallurgy in industry would permit the fabrication

of materials without the prolific power consumption of present methods.

Abolishing the Open Fireplace

Most of these improvements could of course only be put into operation gradually, say over the next twenty years, because of the capital investment needed. They would all gradually make themselves felt in bringing down our fuel consumption. There is however one way of effecting an improvement quickly, namely, by abolishing the open fireplace, which now costs us about 30 million tons of coal per year. I know I am treading on delicate ground but I will dare to risk your displeasure. One should not think of the fireplace from the point of view, say, of the nice fireplace outside this lecture room, or the fireplace in a college common room with enough ‘scouts’ to look after it. You must think of what goes on, say, in a suburb. Each of the houses will have a fireplace which not only heats it inefficiently, but also pours out dirt both into the house and over the town in profusion, injuring the health of the people and adding to the housewives’ troubles another and quite unnecessary job. I have already said that efficiency is not everything; nevertheless, it is something, and even if one has a sentimental attachment to open fireplaces the position has arisen where we simply cannot afford them. To use them is in many respects more wasteful than lighting cigarettes with spills made from £5 notes, as Russian grand dukes are said to have done!

“Naturally there has been quite a lot of discussion on this matter. I have seen a letter written to a well-known economic journal, admitting at least some of the disadvantages of open fireplaces but maintaining that they were worth while from other points of view; in particular this letter emphasized that the fireplace acted as a source of inspiration. I do not want to stress the example of other countries, whose inhabitants after all are not without inspiration, but I have not noticed that people here have more good ideas in

(Concluded, page 29)

Smoke Inspectors' Case-Book

A second selection of records of actual cases of interest and significance. We again invite Inspectors to send contributions for this series.

5. *The Draught that Failed*

THE chimney of a public baths and wash house was consistently observed to emit volumes of dense black smoke for periods much in excess of the time permitted by local by-laws, that is, three minutes in every half hour, to such an extent as to make it quite the worst chimney in that particular district.

The boiler installed at these baths appeared to be a perfectly standard 8 feet 6 inches $\times$ 30 feet Lancashire working at a pressure of 80/85 lbs. per square inch. Each fire tube was fitted with a patent furnace consisting of transverse firebars designed so that when laid side by side perforations in them formed ducts which ran the length of the firebed. Steam jets were installed in these ducts and all primary air passed down them and was admitted to the fire through openings at the top of each duct. The boiler was hand-fired with coal singles. No draught gauge or CO₂ indicator was provided. Steam demands were reasonable and fairly steady, and the boiler could cope with its work without any need for forcing. Because of this the excessive smoke emissions were for some time attributed to carelessness on the part of the firemen. Two firemen were employed and the performance of the chimney varied very little whichever one was on duty.

It was therefore decided to take along a skilled and fully certificated stoker to demonstrate to these firemen that the boiler could be fired smokelessly. A proper system of side firing was adopted as against the rather haphazard methods normally employed, the fires were thickened and the draught properly balanced up, but to our mortification, after an hour of this the steam pressure

dropped to such an extent as to make it difficult to carry on work in the wash house, and what was worse, smoke emissions from the chimney reached an all-time high.

In view of the failure of this procedure and so as to obtain a better picture of conditions in the furnaces, it was then decided to have inspection holes 1 in. in diameter punched in the brickwork of the side and main flues so that instruments could be inserted at various points. Readings which were subsequently obtained showed a CO₂ content in the flue gases varying from 8 per cent. to 12.5 per cent., and draught ranging from 0.15 in. W.G. over the fires to 0.25 in. W. G. in the side flues and 0.5 in. W.G. in the main flue. There was no immediately obvious reason for the lack of draught, and when the boiler was next shut down for cleaning the opportunity was taken to inspect the flues and furnace tubes. It was then found that the boiler was not standard as was thought, but that each firetube contained two Galloway tubes, and that in front of the foremost tube in each case a brick pillar of triangular section had been built, with the apex of the triangle pointing to the furnace. No satisfactory reason for the construction of these pillars could be ascertained, but the most probable theory was that they were originally intended to protect the front crosstube from the direct heat of the fire. However, their principal effect appeared to be a very considerable reduction in the draught in the furnaces. On advice, therefore, these pillars were removed, and at the same time the bridge lowered slightly. The effect on the boiler was most gratifying. The chimney changed

from being a very serious offender against the smoke by-laws to become a model for the whole neighbourhood. In addition to the improvement at the chimney top, a saving of at least 5 per cent. in the coal bill for these baths was reported.

This incident illustrates the help that

can be obtained from the proper use of instruments, and indicates that access holes for portable apparatus might well be made at suitable points as standard practice when flues are being constructed or repaired, even if no permanent instruments are to be fitted.

—J.H.W.

6. *Metal Melting*

Some years ago my District Inspector reported that a large metal refining company on his district were erecting a sixty-foot, round, iron stack adjacent to a cupola, and that a by-pass pipe with butterfly valves led from the cupola to the newly erected stack. As the firm had been prosecuted previously for excessive emissions of black smoke, this new development aroused a certain amount of curiosity.

In due course the cupola plant was put into operation and large volumes of white smoke were emitted from the chimney stack. Observations were made and an emission of sixty minutes duration noted. This smoke swirled down, affecting adjacent houses and could be traced a quarter of a mile away. After the observation the works manager and works chemist were interviewed and the cupola plant inspected. The work in progress consisted of the intermittent melting of scrap non-ferrous metals in the cupola, similar to the everyday practice of melting pig-iron, the duration of the melting taking about six to eight hours. It was stated that the object of the additional stack was that as the cupola would not stand being raised, a sixty-foot stack was erected to give greater dispersal of the smoke given off. A letter was sent, covering the observation and visit, and the matter reported to the Health Committee, who sanctioned the service of an abatement notice requiring the owners to comply with certain requirements to abate the nuisance.

In the meantime, many complaints were received from nearby tenants, also outdoor workers in adjacent brickworks and goods depot. Traffic was also being

interfered with on the nearby main roads, depending, of course, on the atmospheric conditions such as humidity and wind direction.

When the period stated on the abatement notice had elapsed, further observations were made during the daytime but no excessive emissions were noted. Several further complaints confirmed my theory that the firm had resorted to using the cupola during the night time only. This necessitated a dawn observation and a further emission of sixty minutes duration was noted. During this observation details were made of the smoke blowing into bedrooms of houses, and the effect of this whitish smoke on visibility.

Again the works were visited and the charge-hand interviewed. The working conditions of the cupola plant were noted and a letter was served within twenty-four hours, notifying the firm of the visit and the observation. The matter was again reported to the Health Committee who resolved that the Town Clerk should be instructed to institute legal proceedings, and the information was duly laid. The case was heard in a Court of summary jurisdiction and a magistrates order, to abate the nuisance in three months and to carry out the work required by the Local Authority was granted.

This work was eventually done and consisted of the treatment of the smoke through large brick chambers with cooling pipes and cleaning doors, with a final treatment in an adjacent building through bag filters. This method of treatment allowed for the collection of the zinc oxide which was about 10 per cent. of the content of the smoke,

and which naturally gave the smoke its white colour. The firm found a market for this by-product and so recovered

part of the cost of the treatment, but above all abated the nuisance.

—“Farench”

7. Zinc Oxide Problem

At the beginning of 1940, a firm engaged in the recovery of non-ferrous metals from scrap, installed three rotary-type furnaces for the refining of metals.

The furnaces, when in operation, discharged clouds of zinc oxide into the works and atmosphere outside. In addition, columns of white smoke were emitted from the chimneys. The immediate locality became covered with a white deposit, and at times the clouds of white smoke were so dense as to render the passage of vehicles along the road adjoining most difficult.

To remedy the nuisance, it was suggested that the furnaces should be enclosed, disconnected from the chimney and ducts provided to carry away the zinc oxide to cyclones, coolers and a bag filtration plant. The heat generated however, was found to be too great for the bags in the filtration plant, and the bags perished and collapsed very quickly. It was also found that when “blowing” took place in the course of the process, the quantity of hot gases and oxides to be dealt with was greatly increased. To overcome these troubles, a settling-chamber and an additional bag filtration plant were added. Later it became possible by the addition of further cyclones to do away with the settling-chamber.

Another problem which occurred was the inability of the automatic shaker to operate after a few hours owing to the amount of oxide collected, special attention had to be given to the cleansing of filters, and the revolution of the fans had to be adjusted.

Some “pot furnaces” which also discharged considerable quantities of white smoke were moved to enclosed premises, the flues lengthened, and gas and electrical furnaces installed.

This nuisance was dealt with during the war years when materials and plant



Close-up of the Works, 1944



The same Works, 1949

were difficult to obtain, but nevertheless approximately 100 per cent. of zinc oxide is recovered, and prefabricated bungalows have been erected on land adjoining the works.

—W.W.F.

“Gas in Your Home” is the title of a new booklet produced by the Gas Council and Educational Productions Ltd. (Price, 1s. 6d.). It is well illustrated and contains practical information on the operation of domestic appliances by means of simple diagrams.



From Our Photo Library—3

G. B. Heighon

Coke Ovens

The Coal Consumers' Councils

The Industrial and the Domestic Coal Consumers' Councils, set up under the Coal Industry Nationalization Act to watch the interests of consumers, have presented their second annual reports to the Minister of Fuel and Power. The Industrial Council, though hoping for a reduction in coal prices, consider that reduction in fuel costs can best come by increasing efficiency—a 25 per cent. increase in efficiency would mean a saving of at least 20 per cent. in consumers coal costs. It is noted that because of new coal cleaning plants brought into operation, 2 million more tons of dirt were removed from coal in 1948 than in 1947.

The Domestic Council dealt with 90 complaints during the year, more of which were about quality than about

price. The Council are of the opinion that the most promising advance towards satisfying the consumer is by the installation of modern solid fuel appliances, and think that at some stage it may be in the national interest for the Government to assist in the replacement of inefficient appliances. An investigation by the Social Survey in 1948 showed that relatively few people are aware that improved labour-saving solid fuel appliances are available or are concerned about the wastefulness of the older type of open fire.

(The Society's new President, Dame Vera Laughton Mathews, is Chairman of the Domestic Council, and our Honorary Treasurer, Sir Ernest Smith, is Chairman of the Industrial Council.)

Smoke Prevention Abstracts

Special Abstract Record of Papers Read at the Atmospheric Contamination and Purification Sessions of the Conference of the American Chemical Society (Division of Industrial and Engineering Chemistry) at San Francisco, March 27th to April 1st, 1949.

99. Introductory Remarks, Johnstone, H. F. (Illinois Univ.). New methods of sampling and analysis of gases and aerosols can be used to identify the nature and source of objectionable pollutants. Smoke and dust are no longer the major problems in air hygiene. They can be controlled, as demonstrated by the notable improvements in air sanitation made through the smoke abatement programmes of several cities. Much remains to be learned of the effects of aerosols, fumes, and mists or organic and inorganic materials.

Elimination of these nuisances is best accomplished by treatment at source. New devices and improvements are available for removing submicron particles from gases, even when it is necessary to treat large volumes and when the contaminant is present in very low concentrations. Economic considerations may indicate the desirability of construction of tall stacks, and discharging obnoxious gases under controls based on meteorological and seasonal conditions.

100. Historical Review of Smoke and Fume Investigations, Swain, Robt. E. (Stanford Univ., Calif.). In view of the multitude of papers no general review is attempted but subject matter is presented chiefly by the case method, in which a few of the outstanding and representative instances of damage to plant and animal life, and to property interests, by emanations from industrial plants are cited. With review of contributions on the action of these emanations and of successful remedial measures.

101. Legal Regulation of Air Pollution, Hartmann, M. L. (Los Angeles Air Pollution Control). Dense smoke is generally prohibited and the

trend is towards tighter prohibitions against emissions of fly ash, metal and other fumes, and noxious gases. Pollutants other than smoke are being specifically prohibited above specified amounts and concentrations, and regulatory powers more positive than common law nuisance or public health actions are being given to regulatory officers. Control is effected by inspection and sampling of discharges, by permits to operate existing equipment; by permits to build or install new equipment from which air pollutants may be discharged; and by control of the quality and kind of fuel used. Especially rigid requirements have been set up in industrial areas where atmospheric temperature inversions result in accumulations of air pollutants which would otherwise be rendered harmless by diffusion.

102. Los Angeles Smog Problem, Magill, Paul L. (Stanford Research Inst., Calif.). Los Angeles smog is unique in producing severe eye irritation, though only on some 20 occasions a year and then in only limited areas and for relatively brief periods. Reduced visibility occurs much more frequently. The nature of the substances causing eye irritation is not yet known, but much research is in progress.

103. Nature of Industrial Dusts and Fumes in Los Angeles County, McCabe, L. C., Mader, P. P., and McMahan, H. E. (Los Angeles County Air Pollution Control), and Chaney, A. L. (Chaney Chemical Laboratory, Glendale, Calif.). This paper discusses the nature and source of industrial dusts and fumes, and their relation to meteorological conditions, in the Los Angeles basin. Data are submitted and methods used for estimation of SO_3 and SO_2 are

described.

104. Development of Air Pollution Standards, McCabe, L. C., Rose, A. H., and Hamming, W. J. (Los Angeles Air Pollution Control). Atmospheric control standards should effectively limit atmospheric contamination and provide the technical basis for the design or modification of equipment. Tests were conducted and are summarized under : effluent to weight ratio, hourly mass rate of emission, and average mass rate of emission. The data obtained from the correlation of the tests together with collecting efficiencies of existing machinery were used to calculate an allowable discharge curve.

105. Use and Limitations of the Midget Impinger for Locating Dust-Producing Areas, Charmbury, H. B., Chen, W. L., and Wright, C. C. (State Coll., Pennsylvania). The method consists of drawing a given volume of dust-laden air through a small orifice and having it impinge against a glass plate beneath a liquid surface. The dust is momentarily stopped, wet by the liquid, and trapped. The amount of dust is determined by counting the number of particles in an aliquot portion of the suspension. The method has definite limitations which make it an empirical or relative method, but has been used in mining operations and in a town, where samples were collected from 40 different locations, the concentrations plotted and dust concentration contours drawn which indicated the dusty areas.

106. Sampling of Aerosols and Correlation of Sampling Data, Fisher, M. A. (Armour Res. Foundn., Inst. Tech., Chicago). Techniques and complications of sampling problems and related matters are discussed.

107. Measurement of Visibility by Photographic Photometry, Steffens, Carsten (Stanford Research Inst., Calif.). The paper calls to the attention of those concerned with air pollution a method that has been developed by students of the physics of the atmosphere for measuring the extent to which visual range has been reduced by murkiness. A black object that is far enough away

to be partially obscured is photographed, the photographic densities of the images of the object and of the adjacent sky are measured on the negative, and the visual range is calculated from these densities, the distance to the object, and the contrast of the film. The method is practicable only when the atmosphere and the illumination are uniform throughout the region that can be seen.

108. Method for Determination of Free Sulphur in the Atmosphere, Magill, Paul L., and Rolston, Myra. (Stanford Research Inst., Calif.). A revision of F. Feigl's spot test for elemental sulphur has resulted in a field method capable of determining concentrations as low as 0.005 p.p.m. sulphur to within 90 per cent. accuracy, using 1 cubic foot of air. This depends on the formation of thallium polysulphide by sulphur and thallos acetate when treated with hydrogen sulphide in the pores of filter paper. Using the revised method, the prepared thallos acetate papers may be stored indefinitely for field use. Aerosol samples are analysed by spotting that portion of the paper through which the gases have been passed (usually a 0.5 in. diameter circle) with a drop of pyridine, immersing the paper in hydrogen sulphide, washing with acid, and comparing the polysulphide spot with standards.

109. Effects of Additive and Atmosphere-Derived Fluorine in Tennessee Soils and Forage Crops, MacIntire, W. H. and Associates (Agricultural Exp. Station, Tennessee Univ.). 20 years' investigation on fluorine in soils and forage crops are described. Sources of fluorine may be natural, from fertilizers, or derived from the atmosphere. Abnormal incidence in forage crops, reaching toxic levels are deemed attributable to contamination from the atmosphere.

110. Sulphur Dioxide in the Atmosphere and its Relation to Plant Life, Katz, Morris. (Defence Research Chem. Labs. and National Research Council, Ottawa). In concentrations higher than about 0.40 p.p.m. SO₂ may be toxic to sensitive plants at periods during the growing season

when physiological activity is high and conditions for rapid absorption by the leaves are at a maximum. However, low concentrations, in the 0.10 to 0.20 p.p.m. range have demonstrated to be without influence on plant life, in the absence of visible markings. There is no effect in this case after long-continued exposure on rate of growth, yield of crop, photosynthesis, respiration, or daily march of the stomata. The effects may be beneficial if the plants are growing in a sulphur-deficient soil or nutrient. No basis in fact has been found for the theory of invisible injury.

111. Dilution of Waste Gases in the Atmosphere, Church, Phil. E. (Washington Univ.). Using a constant concentration of oil-fog forced up a 200-foot stack, the results of 36,000 samples of diluted oil-fog taken near the ground during unstable conditions and 4,000 taken in the air during stable conditions are given with respect to types of mixing and amount of dilution under these two major atmospheric conditions.

112. Dispersion of Gases from Tall Stacks as a Means of Pollution Control, Thomas, M. D., Hill, G. R., and Abersold, J. N. (American Smelting and Refining Co.). Extensive data covering 15 years of continuous recording of SO₂ concentrations at fixed stations near two smelting plants are analyzed in the light of the equations of Bosanquet and Pearson, and Sutton. Results agreed well with the Bosanquet and Pearson formula, despite obstructions in the terrain in one case. It seems improbable that Sutton's analysis could apply to these data.

113. Dissemination of Aerosol Particles Dispersed from Chimneys, Baron, Thomas, Gerhard, E. R., and Johnstone, H. F. (Illinois Univ.). An approximate method has been developed for the estimation of deposition of aerosol particles from point sources based on the statistical methods proposed by O. G. Sutton.

114. Deposition of Aerosol Particles from Moving Gas Streams, Johnstone, H. F., and Roberts, M. H. (Illinois Univ.). The efficiency of deposition of

aerosol particles on water droplets moving by centrifugal force across a rotating gas stream is calculated on the basis of Sell's theory of impaction. The development of the new Venturi scrubber for collection of dust and absorption of gases during the atomization of a liquid in a high velocity gas stream is described. Large scale installations have given efficiencies of removal of fume from industrial gases between 92 and 99 per cent.

115. Fundamental Considerations in Design of Exhaust Ventilation for Solid Materials Handling Operations, Pring, R. T., Knudsen, J. F., and Dennis, R. (Kennecott Copper Corp.).

116. A Survey of Atmospheric Pollution in Leicester, England, Richards, S. H. (Fuel Research Station, London). An outline of the 1937-39 investigation published in the H.M.S.O. report.

117. Recent Observations in Electrical Precipitation and Mechanical Dust Collection, Schmidt, W. A. (Western Precipitation Corp., Los Angeles). In addition to other factors causing variations in the rate of precipitation it is shown that the resistivity of the deposit is an important factor. Another factor frequently overlooked is that of erosion, which can be minimized by proper gas distribution and electrode configuration. In mechanical collectors the questions of turbulence, drag effect, and other factors that cannot be definitely evaluated, are discussed.

118. Development of the Venturi Scrubber, Jones, W. P. (Chemical Construction Corp., New York). Describes a new method of wet gas scrubbing, utilizing high gas velocity in the throat of a Venturi tube for collision with and fine atomization of a stationary sheet of scrubbing liquid. There are now three large commercial installations in satisfactory operation.

119. Agglomeration of Smoke and Dust Particles by Sonic Waves, St. Clair, H. W. (U.S. Bureau of Mines). Gives a summary of the experimental work of the Bureau of Mines and discusses briefly the physical phenomena

involved and the problems of industrial application.

120. Status of the Development of Industrial Sonic Agglomeration and Collection Systems, Danser, H. W. (Ultrasonic Corp.), and Neumann, E. P. (Ultrasonic Corp. and Massachusetts Inst. Techn.). Discusses the physical variables to be taken into consideration in designing industrial plant, and gives examples of industrial applications. Finally, evaluation is made of the characteristics of types of industrial fine particle collection problems found to lend themselves to sonic agglomeration and collection treatment.

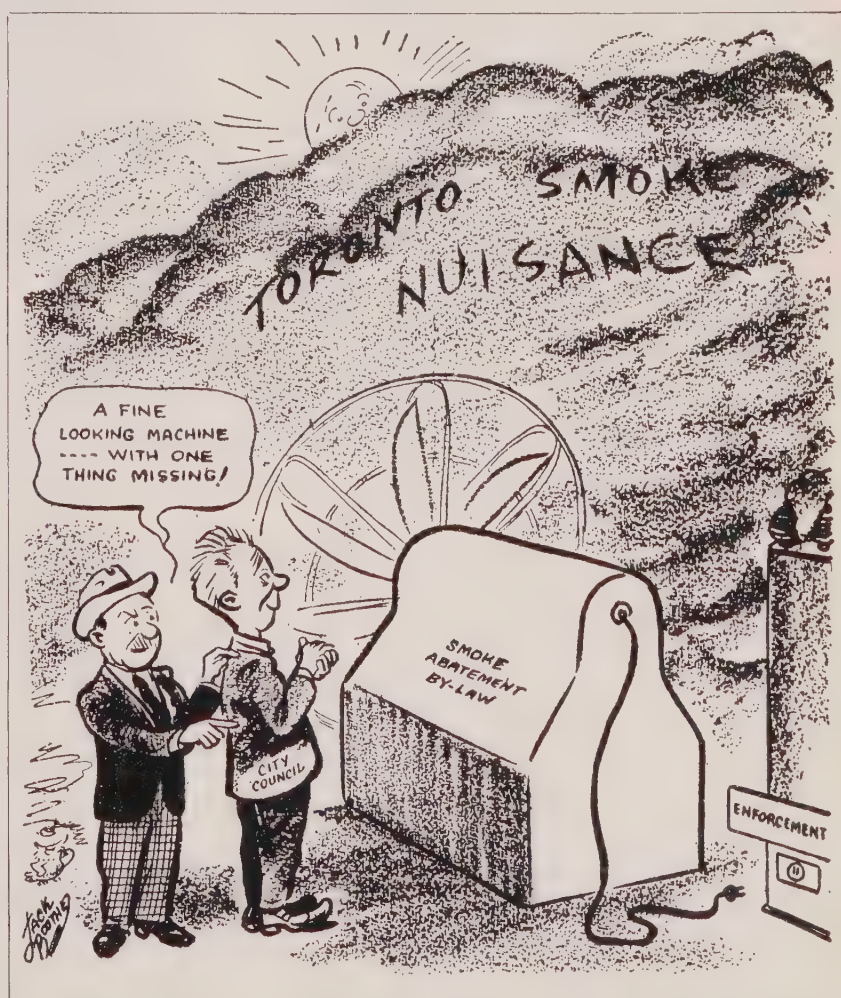
121. Electrostatic Cleaning of Atmospheric Air, Lincoln, R. L., and Cooper, F. E. (Westinghouse Electric Corp.). Gives a short history of electrostatic gas cleaning describing the basic principle of operation and the difference between the Lodge-Cottrell and the Penney systems. Continues with a description of current commercial apparatus and the factors which influence the design and application of such apparatus.

Power Sources and Power Utilization—concluded

winter than in summer ; thus, I venture to suggest that there must be other sources of inspiration available apart from the contemplation of the fluctuations of a household appliance. Of course it may be that some people especially want to have rheumatism ; to these however, I can suggest various ways of acquiring it in a much more economical way.

"The immediate abolition of open fires would, in my opinion, be the greatest and easiest step towards economic recovery. They could be replaced by simple stoves designed to fit into existing fireplaces. I believe the government could not spend any money more profitably than by offering to provide and install such stoves free of charge. If only half the owners of fireplaces accepted this offer, about 10-15 million tons of coal could be saved each year at a capital expenditure which, if the enterprise were organized properly, could not be more than £30 million.

This reproduction of a recent cartoon from a Toronto newspaper, on a new smoke abatement ordinance adopted in that city, illustrates a cautious Canadian opinion on a point that applies to smoke legislation everywhere

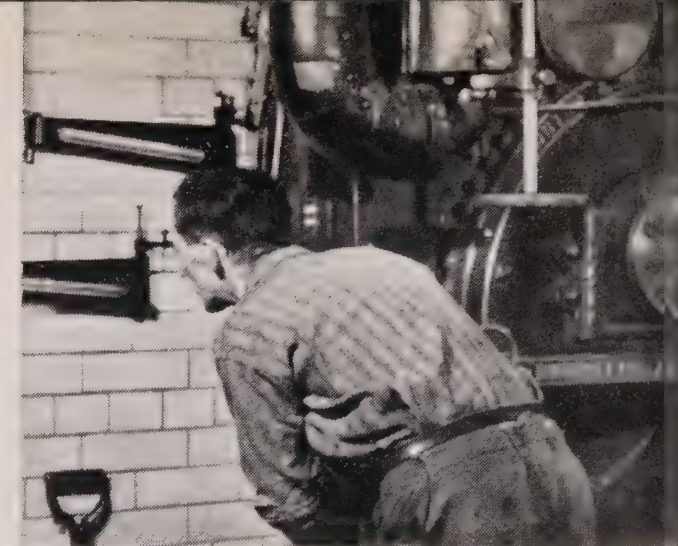


Combustion Screened

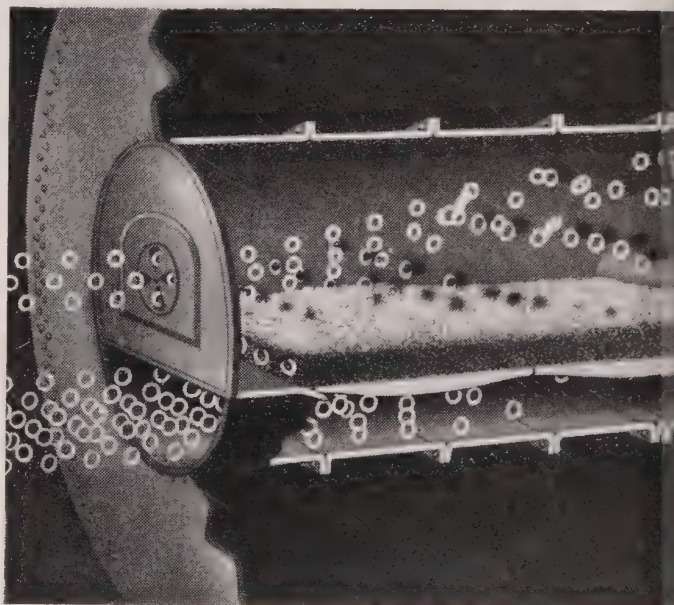
The Central Office of Information have produced, for the Ministry of Fuel and Power, a first-class instructional film on the principles of combustion in boiler plant. "CO₂ and Draught" is a Blackheath Film Unit production and is intended for the instruction of boiler-men in firing and maintenance. This it does with exceptional clarity by means of sequences showing a boiler furnace being fired and regulated, and by animated diagrams and straightforward commentary. The diagrams show in a most effective way how combustion proceeds, and make clear the all-important fact that air is an equal partner with fuel in the chemical union of oxygen and carbon that constitutes combustion.

The formation of smoke and carbon monoxide, when there is insufficient air, is stressed, and how smoke is formed is shown by a piece of coal placed in an electric furnace—showing how it becomes hot and bursts into flame and smoke when the ignition point is reached. With insufficient air it burns lazily and with heavy smoke, but as soon as a stream of air is directed towards it the rate of burning becomes more intense and the smoke disappears.

Many other points of practical importance are illustrated, and not only were we impressed by the content of the film but the way in which it has been used. In its photography, sound, and



*Fireman Inspecting Water Gauge.
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animation the film has a clean, crisp quality that greatly helps its purpose. It ought to be seen by every boilerman in the country.

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the component gases and allow their recombination at a much lower temperature. According to *Chemical and Engineering News* (Washington) the flame, when the catalyst is introduced, "changes rapidly from a long reddish smoky flame to a short intense dazzling white, having quite a different sound from the original." It is also said that the cleaning of the fires is made easier and in less time, because of reduced clinker formation.



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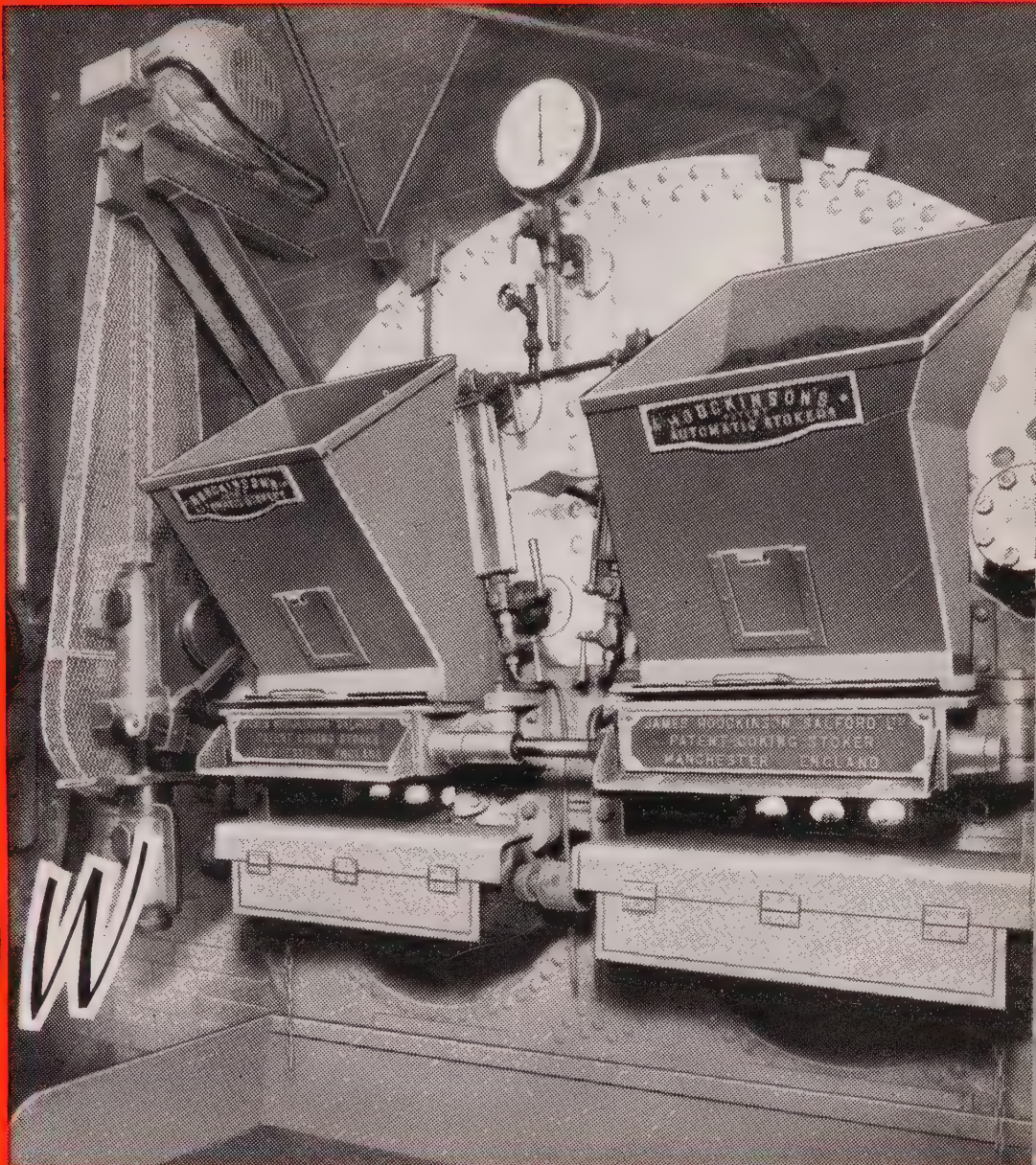
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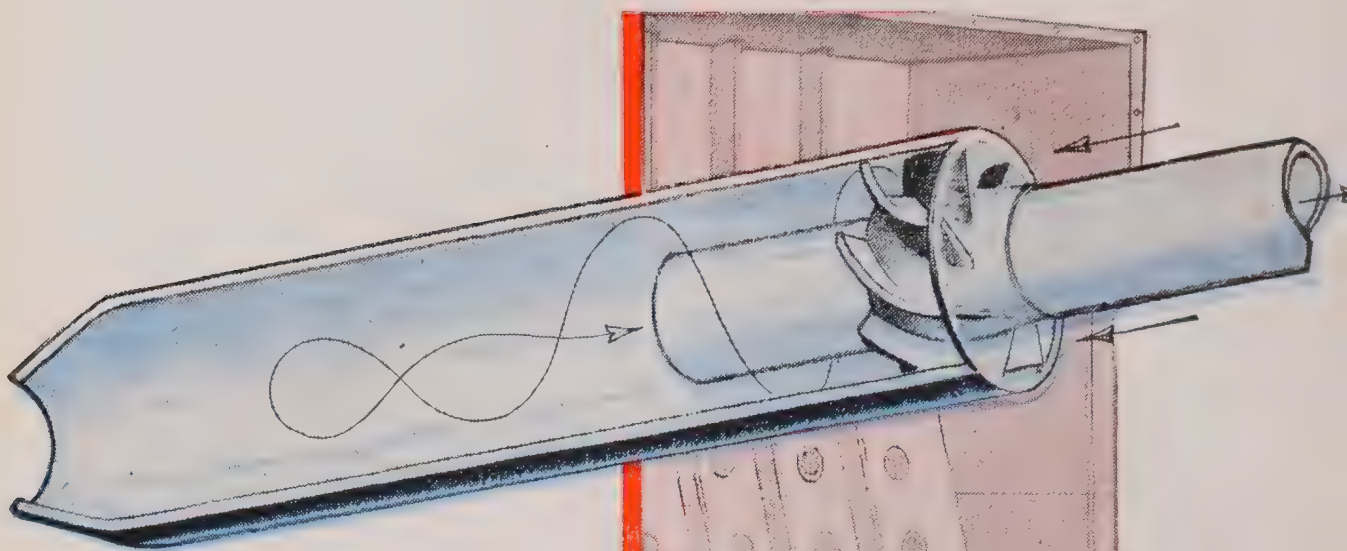
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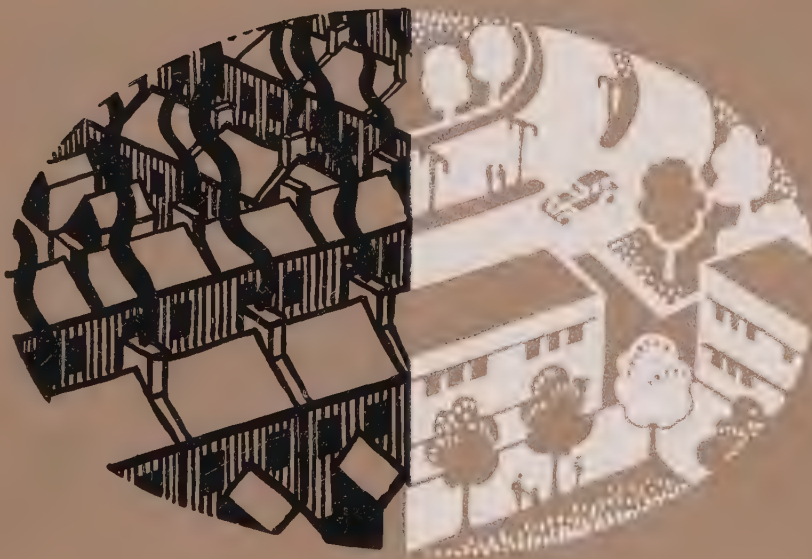
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 72

WINTER

1949

ONE SHILLING

In this Issue

Productivity
What They Said at Harrogate
Smoke Inspectors' Case Book
New Publications Reviewed
Smokeless Homes



GIVE UP SMOKING?

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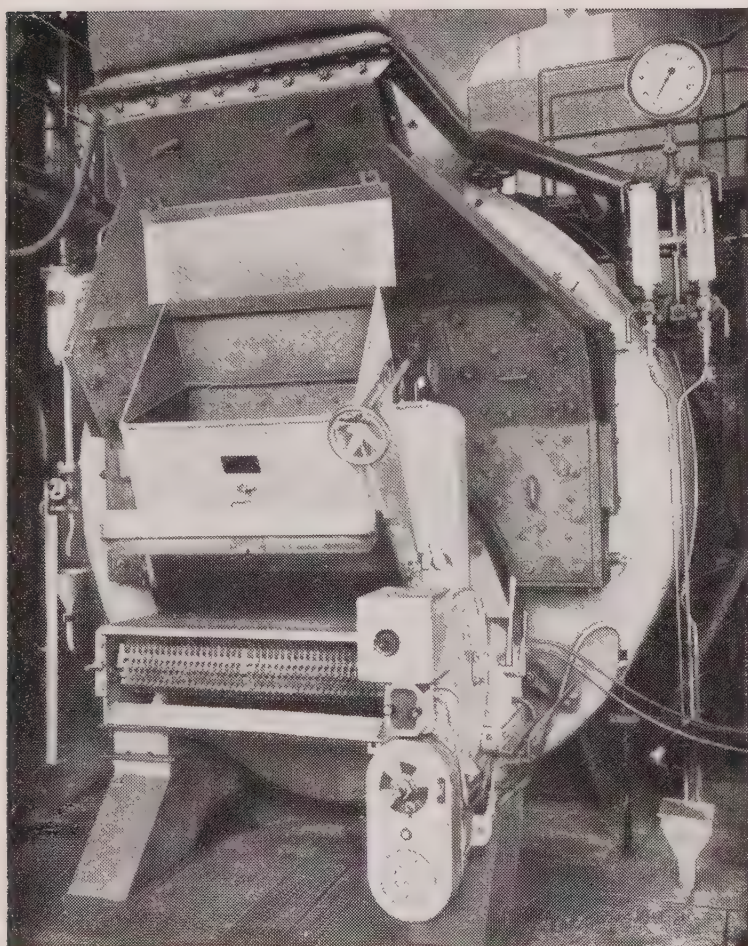
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SMOKELESS AIR

Vol. XX. No. 72

Winter, 1949

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ships, towers, domes, theatres and temples lie open unto the fields, and to the sky; all bright and glittering in the smokeless air.



“Productivity”

PRODUCTIVITY, not without reason, is the vogue word of the year. Ways and means of producing more and exporting more are the concern of all of us. In any operation there are two ways of increasing production: by working harder and longer, or by performing the operation more skilfully, more efficiently, less wastefully. This applies to the multitude of operations that go to make up national productivity, and in practice progress can often best be made by combining more work with more efficiency. It must, however, be remembered that if we work harder at a job that is being done wastefully, we are both producing more and wasting more. To cut out all the avoidable waste should therefore be the first stage, and the harder or longer work—if it is still necessary—should be applied only to the more efficiently ordered job.

This is no mere academic argument. If our economic system is to be geared up for higher production without full attention being given to the primary needs of efficiency in every field, it means that a still greater volume of the nation's potential wealth, appallingly high already, is being lost.

Nowhere is it more urgent for this to receive attention than at the very roots of our industrial life—in the production of heat and power for factory, mine, and transport. Faced as Great Britain is to-day with the necessity for rapidly and thoroughly adapting herself to new and uncomfortable circumstances, it is more important than ever that all measures to increase fuel efficiency, and to use our fuel resources in the wisest possible way, should be prosecuted with greater and not with reduced determination. This is the last place for cuts.

As the Society has stressed on many

occasions, the visible sign of fuel wastage is smoke. Fuel can be and is wasted without smoke, but where there is smoke there is obviously and unquestionably waste. And, as the review on another page of a new Technical Paper from the Fuel Research Station reminds us, where there is a loss of fuel as smoke, there are even greater fuel losses in the form of invisible gases. If a factory chimney is going to emit smoke for eight hours a day instead of seven, in the interests of production, then the loss of fuel (which is a national loss as well as the manufacturer's) is going to go up by 14 per cent. This would be bad enough even if the coal that is being lost—something in the region of 10 million tons a year—were not also one of our most important exports!

In stressing, as is necessary, this vital connection between smoke and fuel waste, we must not overlook the many other ways in which our polluted air helps to hold down productivity. Quite apart from the distinctive diseases and disorders in the causation of which smoke plays a contributory part, there is what is possibly even more serious, though still less measurable: the reduction in the general level of positive health due to living in polluted air, with reduced sun and daylight, and in a dingy, psychologically depressing environment. Clean air and clean towns, more colour and less squalor, more light and less gloom, would tend powerfully to bring about not just more work, but *better* work.

Again, the purely material consequences of smoke represent a direct and substantial diversion of labour and materials from *production to maintenance*. The repair of the damage done by smoke deposits, the cleaning up of the perpetual fall of dust and dirt, the unnecessary repainting and the safeguarding of property—especially merchandise—from damage and scilicet, are activities that have become a familiar and accepted part of our daily life. But they are all entirely unproductive. They mean that vast numbers of men and women who

might be creating new wealth for export or our own use, are having to be kept on work that puts nothing whatsoever into the national kitty. In fact, by using up many materials that could be put to better use they are taking a great deal out of the kitty.

All these factors add up to the conviction that in this time of national crisis our smoke prevention movement should have a bigger and more responsible part than ever to play. The crisis, we fear, must mean that despite all the logic of the situation, the delays and disappointments to which the movement has been accustomed throughout its history, are likely to be increased rather than diminished; but that need not alter or weaken the force of our case. The one great frustrating factor is that our resources are so minute for the task we have to do, but even that means only that we must continue to make progress by a technique of patiently undermining rather than of boldly storming the walls. Even now they are not as strong as they look.

Americana

A legend still lingers in this country that New York is free from smoke and has been so for many years. There does not seem to be the same belief in New York itself, where a few months ago a new smoke prevention ordinance, with a new organization to administer it, came into force. The Smoke Control Bureau, under the acting directorship of William H. Byrne, has a staff of four inspectors, and during its first week received 1,200 complaints, involving 253 "locations." By the end of three months 3,830 complaints, relating to 1,799 locations, had come in.

The Donora fog of October 27th, 1948, which resulted in 20 to 24 deaths (the reports differ) and a total of 5,910 cases of illness—42.7 per cent. of the population—continues to rouse much interest in the U.S.A. A full report, a copy of which we hope to obtain and review in a later issue, has been made by the Federal Public Health Service, and

it is said that it is proved "for the first time that air contamination in an industrial community can actually cause acute disabling disease." Sulphur dioxide was listed as the chief culprit.

There is also news of actions for damages to the value of 2 million dollars being taken against the American Steel and Wire Company, a subsidiary of the U.S. Steel Corporation, on the grounds of wilful neglect in permitting dangerous fumes to hang over the town for the five day period of the fog. Additional suits, totalling 1½ million dollars were expected to be filed on behalf of 121 persons who claimed injury to health.

In Canada new smoke prevention ordinances have been adopted for the cities of Montreal and Toronto. In both cases the new law includes prior approval—full, complete, and obligatory prior approval. A Committee has also been set up, under the Chairmanship of Professor Allcut, to consider whether a model law, suitable for the whole of Canada, can be formulated.

Garden Smoke

About this time of the year columns of watery smoke from innumerable garden bonfires rise into the week-end air, creating what many people regard as the most objectionable form of nuisance. Press cuttings of indignant letters to the editors of local papers come in, and less frequently the Society is asked to help to do something about it. It is an awkward problem, and one that we have never officially considered. There must be few of our members, who though they may firmly refuse to burn a single piece of bituminous coal inside their homes, have not enjoyed disposing of a recalcitrant mound of garden rubbish by having a good old—and often on these wintry Saturday afternoons, warming—bonfire. They may even enjoy the pungent, almost aromatic, tang of the smoke, most of which in any case is water vapour. And there is always the advantage, with one's own fire, that one can stand on its leeward side and easily avoid the

obscuring smoke. It is the fire in our neighbour's garden, which of course is only lit when the wind will blow its smoke over into our garden, in dense, blinding, and reeking clouds, that is the real nuisance.

In point of fact the garden fire must be far less of a nuisance now than it has been in the past, thanks to the rapidly spreading understanding of the art and value of composting. In the well-regulated garden of to-day there is burned only the hard and woody material that will not rot down in the compost heap: everything else from the garden, and a great deal from the kitchen, is rotted down before going back into the soil. Even the stuff that cannot be composted can be burned more readily and with less smoke with the help of an incinerator.

As far as it is destroying good humus-making material we can say that garden smoke is, like coal smoke, a form of waste. We feel, nevertheless, that a reader writing to the *Yorkshire Evening News* recently was rather over-stating his case when he wrote that the white man seems to be destroying himself—"madness indeed, for every garden fire means less fertile soil, smaller crops, fewer livestock." "Every wisp of smoke," he concludes even more emphatically, "is a rasher of bacon, an egg, or a sirloin of beef lost. Let us remember this while there is yet time."

Milestone

The Society was formed in 1929 at a conference in Buxton by the union of the Coal Smoke Abatement Society and the Smoke Abatement League of Great Britain, so that the year 1950 will see its 21st birthday. It is felt that the occasion should be duly celebrated, and to begin with we hope to include in our next issue an illustrated review of the Society's twenty-one years of continuing, though difficult, growth and achievement. It is worth while when such milestones are reached to look back to see and appreciate how far one has travelled.

What They Said at Harrogate

THE Harrogate Conference of the Society was attended by nearly 450 members and delegates, only a few short of our record figures. Though mostly local authority delegates, there was a larger number than hitherto of representatives of fuel and other technical organizations.

Lord Simon of Wythenshawe, the retiring President, opened the proceedings with a review of the history of the campaign against domestic smoke. The conference was visited by Mr. Arthur Blenkinsop, M.P., Parliamentary Secretary of the Ministry of Health, whose address, which was greatly appreciated, is included with the other papers and discussions in the conference "Proceedings" shortly to be published.

An interesting survey of the work of the Fuel Research Station was given by its Director, Dr. A. Parker, and Mr. A. Carr, of the National Coal Board, read a paper on the problem of burning colliery spoilbanks. At the final session Mr. Eric Sinkinson, of the Fuels Department, University of Leeds, gave a stimulating paper on "The Case Against Smoke: An Outside View."

The session of "Progress Reports" was concerned largely with the question of new legislation, and during this discussion the conference heard a speaker not on the programme—Mr. Henry Burns of the Los Angeles County Smoke Control Administration, who gave a lively, high-speed account of what is being done in the U.S.A. His address, though also included in the "Proceedings" will be reprinted either separately or in the next issue of this journal.

Members and representatives of full members of the Society are reminded that they may obtain a copy of the "Proceedings" free of charge on request. To others, and for additional copies, the price is 4s. 6d. (by post, 4s. 8d.). We print below some excerpts from the papers and discussions.

The Newton Report

The Newton report was an admirable document. It is a lamentable fact that

so far as action by the Government was concerned it might just as well never have been written.—*Lord Simon.*

Thirty Years

After thirty years there should be no more domestic smoke, and it is reasonable to assume that the rapid increase in the use of electricity for factories and the greatly improved combustion of the modern super power stations will mean the end of any serious emission of smoke from factories (though the problem of metallurgical furnaces may remain). So that we may look forward with reasonable confidence to the end of the smoke nuisance as a whole within thirty years.—*Ibid.*

The Society

Much important work lies before the National Smoke Abatement Society. We have now for the first time the necessary knowledge to solve the smoke problem, and the active good will of the Government. But there is still much ignorance and apathy, and success depends on a great deal of educational work. This can only be done by the National Smoke Abatement Society. Its progress in recent years has been gratifying, but I am sorry to say that its resources have not grown in proportion to the extension of its activities. I very much hope that the Society's appeal for funds which is now being launched will meet with a generous response.—*Ibid.*

Appreciation

I am indeed very glad to be with you because we do appreciate very much the value of the work that your Society has been doing for a long period of years against very real difficulties.—*Arthur Blenkinsop, M.P., Parliamentary Secretary, Ministry of Health.*

Domestic Smoke

The other night I was travelling up North through Durham, and watched



*Arthur Blenkinsop, M.P.,
Parliamentary Secretary, Ministry of Health*

the multitude of blue streams of smoke joining together in the sky, forming a cloud round Durham Cathedral and Castle. I then decided that perhaps you were right, and that the major contribution of smoke nuisance is from the domestic grate, at any rate in our major coal-producing areas.—*Ibid.*

Co-operation

There is no doubt that the best results in the whole problem of industrial smoke nuisance can be achieved by effective co-operation between Local Authorities and industry, because better fuel practice is in the interests of both parties. It is an economy to industry, and it can be a great contribution to the better health and welfare of the community.—*Ibid.*

Smokeless Zones

I myself have been very interested in the proposals that have been put forward for the establishment of smokeless zones. I personally welcome this

development, and hope to see it developed through the country. Some people argue that smoke drifting in from outside areas will spoil the value of the schemes, and will defeat the object of getting willing co-operation of firms and domestic users in the limited smokeless areas. Personally, I do not believe that will be so. I believe it should rather reinforce the demand from the smokeless zone for the steady extension of its area, and that is what I believe we should work towards.—*Ibid*

Fuel Research Station

Since the establishment of the organization about 30 years ago, the work of the Research Station at Greenwich has been steadily developed. The number of staff is now about 250, including about 60 graduates in chemistry, engineering, and physics, and more than 100 industrial workers.—*Dr. A. Parker.*

The Coal Survey

For these reasons the Fuel Research Board early began a systematic physical and chemical survey of the nation's coal resources. Survey Laboratories were set up in all the principal coalfields. . . .

As a result of this survey there is more information about the coals of Great Britain than there is about the coals of any other country.—*Ibid.*

Coal for Gas Turbines

Intensive experimental work is in progress with the object of ascertaining the possibilities of using coal in place of oil as the source of energy for gas turbines. A new Vortex combustion chamber, with cooling by air, has been designed to burn 500 lb. of pulverized coal per hour. If the experiments are successful in satisfactorily burning powdered coal at atmospheric pressure they will be extended to the combustion of the coal at a pressure of several atmospheres. It is hoped that it will be possible in equipment of the same size to burn 2,000 lb. of coal per hour, to give a heat release of the order of 2 million B.Th.U. per hour per cubic foot of combustion space.—*Ibid.*

Pollution Measurement

There are now about 70 authorities co-operating with the Fuel Research Station in making daily and monthly observations in many parts of the country. More than 500 instruments are in use for measuring deposited solid matter, pollution by smoke, and sulphur, and intensity of daylight. One special investigation by the Research Station is concerned with the incidence of pollution by sulphur in selected areas. All these activities are closely linked with other work of the Fuel Research Station on methods of reducing the emission of polluting substances from the burning of fuels and of improving fuel efficiency.—*Ibid.*

The Carrington Survey

The effects of pollution in this area on plant physiology are also being investigated. The interest of the Department of Botany of the University of Manchester and of the Agricultural Research Council has been secured and a full time research assistant has been appointed. A study will be made of the effects of atmospheric pollution on pasturage mixtures used on farms in districts to the north and north-west of Manchester and also on plant life in districts adjoining the Carrington-Partington area. This special investigation is intended to be on a more thorough scale than that undertaken some years ago in Leeds by Cohen and Ruston.—*Dr. C. Metcalfe Brown.*

285 tons p.h.

The case against smoke is self-evident, when we think about it, because it does so much evil to us. We pour smoke out upon ourselves actually at the rate of two and a half million tons each year, or 6,849 tons each day, or 285 tons each hour, or almost 5 tons a minute. Almost half of it comes from chimney pots.—*Eric Sinkinson.*

Our Champion

The case becomes involved because we the public are flinging pots of soot into our own faces, and the National Smoke Abatement Society has had to



Dr. A. Parker
Director, the Fuel Research Station

come forward as our champion to defend us against ourselves. Who will provide the £500,000 a year needed?—*Ibid.*

Not The Last Word

The plea that works engineers are the last word in expert opinion on the question of smoke prevention is scarcely supported by the observation in industrial areas. Some undoubtedly are, but by no means all.—*Dr. W. R. Martine.*

Town Planning

Any Town Planning Authority, if they were so minded, or should he say smoke conscious, could impose conditions to secure as far as possible that the fuel burning plant which was to be installed in any building should be comparatively smokeless.—*G. W. Farquharson.*

Dollars Galore

The organization within the district consists of approximately sixty people. All are engineers or engineers in training, smoke inspectors, etc. All

these people are seriously engaged in this work. We have quite a number of dollars to play with! The annual budget is somewhere between £100,000 and £150,000. Motor cars are provided to travel to destinations; laboratory and research facilities are incidental, but the moneys involved are considerable.—*Henry Burns (of Los Angeles)*.

Prior Approval

The problem of Prior Approval; you people are toying with it—we have it. Under our rules and regulations no person or Company can install any piece of equipment which is capable of producing air contamination unless it has first received prior approval from us. We can, if necessary, go the the extreme of shutting down the plant and stopping work, or arresting the individual.—*Ibid.*

Smoke and Water Supply

Intense fogs, such as those which

covered Britain in November, 1948, deposited their filth on service reservoirs and lay on the water as thick black scum. Although this atmospheric pollution carried with it only small proportions of phenols, the reaction of the water was so strong as to produce noxious tastes making the water completely unpalatable. Such happened in Harrogate in November, 1948, when the great smoke belt from the industrial cities of Yorkshire drifted to Harrogate.—*Delwyn G. Davies (Water Engineer and Manager, Harrogate)*.

£200,000,000

It is difficult to assess accurately the potential increases in water demand due to atmospheric pollution but it was not unlikely that these extra needs required a capital expenditure on waterworks as much as £200 millions.—*Ibid.*

Thames-Side Cement Investigation Deputation to Mr. Blenkinsop

IN April last a report was submitted by its Committee to the Conference of local authorities concerned with the cement works dust problem on Thames-side, when it was agreed that the Minister of Health should be requested to meet a deputation. (A survey of this work was included in the "Progress Reports" at the N.S.A.S. Harrogate Conference).

The Minister was unable to receive a deputation, but they were met by Mr. Arthur Blenkinsop, Parliamentary Secretary to the Minister of Health, on October 6th. Representatives of the local authorities, Members of Parliament for the constituencies concerned, the Chief Alkali Inspector, and other officers of the Ministries of Health, Works, and Supply were present.

The Hon. Secretary, on behalf of the Committee, formally presented the Report to the Parliamentary Secretary. During the discussion the following points were made by the deputation:

(1) The effect upon the housewives living in the area.

(2) Although no proof could be obtained by the Committee of the effect of the dust being detrimental to health, it was felt that it was a nuisance, and attention was drawn to relevant paragraphs of the Report.

(3) Consideration should be given as to whether the staff of the Ministry of Health dealing with works of this nature was adequate for the work to be performed.

(4) A suggestion was made that greater powers should be given to local authorities to deal with this type of nuisance through the Sanitary Inspector.

(5) Copies of the Reports of the Alkali Inspectors should be furnished to the respective local authorities.

The Parliamentary Secretary in reply stated that apart from the question of its effect on health he had no doubt

about the nuisance caused by cement dust. He pointed out that priorities for steel had received the support of the Ministry of Health and a large amount of plant had been delivered. As a result he was informed there was a considerable improvement in both high and low level emission. Due to the urgent need for cement there was no likelihood of the existing cement factories being removed, but it was the policy of the Government that new factories should be erected in other parts of the country. It was hoped that the whole of the factories in the Thames-side area would be provided with the necessary dust arrestment plant within a period of two years, and the Ministry of Health were satisfied that when this was installed it would be such as to get the nuisance down to a minimum.

The Chief Alkali Inspector, Mr. A. Damon, confirmed that in his opinion when electrostatic precipitation plant was installed in all the factories there should be 95 per cent. efficiency of dust arrestment. It has been ascertained that the dust from the low level emission was greater than was at first thought, but appropriate steps were being taken to deal with this question.

The Committee feel that the question will continue to receive the very serious consideration of the Ministry, but they repeat that "when every possible step has been taken to reduce the nuisance to the lowest possible minimum there will still be a nuisance at times, as a slip of even 5 per cent. through the dust arrestment plant in connection with big cement production would be equivalent to a substantial deposit per square mile per annum."



From Our Photo Library—4

R. B. Huckle

"Calm was the day, and through the trembling air
Sweet-breathing Zephyrus did softly play . . .
Along the shore of silver-streaming Thames."—*Spenser.*

New Publications

Atmospheric Pollution — Efficiency in Lancashire Boilers — the Alkali Report

26th Report on the Investigation of Atmospheric Pollution, on Observations for the 5 Years ended 31st March, 1944. H.M. Stationery Office, 2s. 6d.

Despite the war, the collection of statistics on atmospheric pollution was continued, but only recently has it been possible to analyse the data. This work is carried out by the Department of Scientific and Industrial Research with the aid of the Standing Conference of Co-operating Bodies who make local observations.

All the earlier Reports were for periods of one year, but there are some advantages in making this new Report cover a 5-year period. Observations of this type can best be judged statistically when they cover long periods. The present Report contains, for purposes of comparison, data relating to similar 5-year periods going back in some cases as far as 1914.

During the war, the restrictions on emitting pollution were partly relaxed and for a period industrial concerns were encouraged to make smoke for camouflage purposes. Despite this, the records of local authorities and others co-operating in this nation-wide investigation do not show any appreciable increase of smoke in the air of the country as a whole. An increase in the deposition of ash has been observed, however, and this may be due to increased industrial activity combined with overloading of industrial boilers and furnaces, and the tendency for industrial coal to contain more ash.

When real changes in atmospheric pollution were observed, whether for better or worse, an attempt was made to seek an explanation. In the Report, 135 such cases are examined; rather more than half being cases of reduced

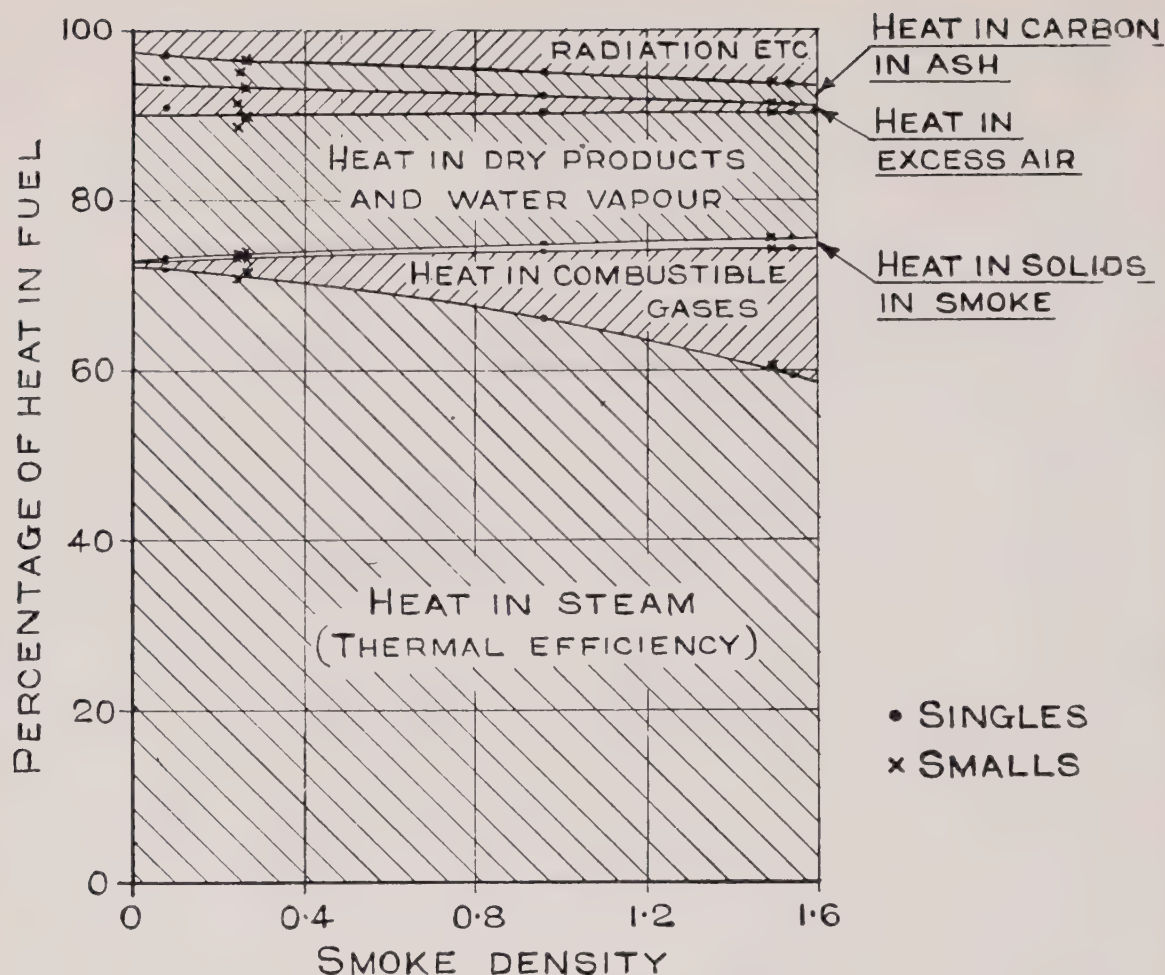
pollution. The drive for fuel economy was significantly one of the major explanations of local improvements.

In agricultural districts of the country the war-time effort to produce more home-grown foods produced a noticeable, though small, effect on material collected in several rural deposit gauges. The effect of ploughing grass-land, and of intensive cultivation, is to increase the tendency for wind-blown dust to be collected in deposit gauges.

The effect of air raids on observations was variable. In some cases, due to the creation of devastated areas, there was a marked reduction in atmospheric pollution. Isolated cases of increases due to air raids, demolitions or repair operations were noted, but these were disregarded in calculating mean values for the whole country so as to avoid giving any false impressions of industrial pollution.

The invisible pollution of the atmosphere by sulphur gases is almost directly proportional to the quantity of coal burned irrespective of the size or type of the combustion appliance used. An interesting series of fluctuations in sulphur-dioxide measurements at a group of 20 stations was observed during the period 1935-1944. From the middle of 1939 until the time of Dunkirk in 1940, there was a period of decreasing industrial activity with a corresponding fall in sulphur pollution. Thereafter there was a marked and rapid increase in the consumption of coal necessarily involved in the war-time production drive, and the result from the atmospheric pollution point of view was inevitable—a corresponding rise in sulphur-dioxide pollution.

The general conclusion from the Report is that, contrary to the tendency during the 1914-18 war period, there was no marked and general increase of



Reproduced from "Fuel Research Technical Paper No. 55," this is one of the most important illustrations ever published in support of the case against smoke. Note the substantial fall in thermal efficiency as smoke density increases—mainly because of the invisible combustible gases that accompany the visible smoke

atmospheric pollution during the war period 1939-44, but the improvement of atmospheric cleanliness was temporarily halted. The Report concludes on the note, however, that pre-war standards were far short of perfection and five years went by without any major attempts at improvement. The present rebuilding and general reconstruction offer many opportunities, which should on no account be missed, of improving the state of our atmosphere.

Fuel Research Technical Paper No. 55. The Effect of Certain Factors on the Efficiency of a Hand-fired, Natural Draught, Lancashire Boiler.

In many factories and works, both large and small, the process operated is such that the best method of raising

steam is with a shell-type boiler. Many of these boilers are hand fired and they are so numerous that they use millions of tons of coal every year.

It is well known, however, that a large number of these boilers are operated inefficiently. This can arise from many causes. Too much excess air may be used; unskilled firing may leave holes in the fuel bed on the grate; in many cases too little air is supplied and smoke results.

In Technical Paper No. 55, recently issued by the Fuel Research Station of D.S.I.R. a study has been made of the hand-fired, natural-draught, Lancashire boiler and the magnitude of various losses due to inefficient operation has been assessed. It is demonstrated that maximum efficiency is obtained when the air supply is restricted to the minimum necessary to give no smoke.

It is well known that too much air causes losses of heat up the chimney, but the Paper stresses that the losses due to a small decrease below the optimum air supply can be as bad as those caused by a large increase. The smoke made by using less air than the optimum is merely a visible sign of reduced efficiency caused mainly by the invisible combustible gases that invariably accompany smoke. These gases cause four or five times the losses for which the visible constituents of the chimney gases are responsible.

The Paper gives precise data to show the effects of varying load on efficiency and the effects of soot blowing. The efficiency of the boiler and superheater reached a maximum of 74 to 75 per cent., using washed singles or smalls, over the range 60 to 80 per cent. of full load. The efficiency varied by only $2\frac{1}{2}$ per cent. on these fuels over the range 40 to 100 per cent. of full load. Soot blowing uses about 0.3 per cent. of the steam generated, but avoids losses of efficiency that can amount to 6 per cent. after about one month's working without soot blowers.

The information given in the Paper can be applied to measure the cost of inefficient operation. Reference is also made to a practical method of avoiding unnecessary heat losses by the use of a simple, smoke-eliminating fire-door. These doors, designed and tested at the Fuel Research Station are now being introduced into commercial operation by a number of firms. The fundamental idea is to supply the correct amount of air, not too much or too little, over the fire in such a manner as to burn the volatile matter of the coal in the furnace.

Trials have shown that smoke can be completely eliminated and, with it, the enormous waste of heat in the invisible combustible gases. To achieve this result does not require elaborate manipulation of the fires or call upon the fireman for any more skill than is required to keep the grates evenly covered with fuel. His only additional duty is to close a flap-valve at a stated interval after closing the furnace door.

No fine adjustments of the doors are provided or required to deal with different types and sizes of coal. A constant firing cycle is recommended and, if that is adopted, variations of load merely require corresponding variations in the quantity of fuel fired.

The Paper indicates that the conversion of this type of boiler to pulverized-fuel firing can lead to some gain of efficiency. It points out that many factors besides efficiency require consideration but concludes with the statement that, if correctly fired, a hand-fired, natural-draught, Lancashire boiler, fitted with the new fire-doors, may have a thermal efficiency upon which it is difficult to improve by adopting mechanical stoking.

85th Annual Report on Alkali, &c. Works. For the Year 1948. H.M. Stationery Office, 9d.

Spoilbanks, electricity generating stations, metallurgical furnaces, iron and steel works and foundries, gas works, and fluorine emissions, as well as the many processes registered under the Alkali Works Regulation Act, are among the many sources of atmospheric pollution, in one form or another, discussed in this report.

Colliery spoilbanks emitting much smoke or fume show a decrease of one over 1947, but there was an increase of 8 among those emitting slight smoke or fume. Commenting on the general position, the report says: "There are marked differences in the energy with which burning spoilbanks are tackled, but the supply of pipes and pumps has been a trifle easier and colliery officials have in most cases shown an active interest in securing and maintaining control over these troublesome fires. It must be admitted that some spoilbanks are now reaching such a size that effective water spraying is becoming a very difficult problem. In such cases there is much to be said for the practice of continually levelling and consolidating the refuse. Where this has been done the results have been satisfactory and apparently permanent. From the colliery aspect it serves to prolong the

useful life of a tipping area and from the public point of view it results in the formation of a less offensive mound than the average spoilbank. These advantages might be set against the cost of the operation which is somewhat high."

An increasing number of complaints have been made during the past two years alleging the discharge of excessive smoke, soot, grit and fumes from gas works. In every case, it is said, they have had reference to the operation of horizontal retorts, the handling and screening of coke, and the use of water gas plants or steam raising. In the opinion of the Chief Inspector, "it is not possible to operate horizontal

retorts installations without giving some offence to residents in the immediate vicinity, although some mitigation can be secured by the use and skilled operation of suitable coal-charging machines and methods of coke handling."

The problem of fluorine is dealt with in a special appendix. Processes discussed as giving rise to emissions of this gas, which may have serious consequences to livestock feeding on affected herbage, includes brickworks, the calcination of ironstone, steel processing, and under certain conditions, from pottery kilns.

A shorter separate report by the Chief Inspector for Scotland is included.

News from the Divisions

East Midlands

A MEETING of the Division was held in the Council Chamber, Town Hall, Leicester, on November 10th. Sixty-five delegates and members present were welcomed by the Lord Mayor of Leicester (Alderman J. W. Wale). A paper on "The Householder and Smoke Abatement" was read by Mr. E. D. L. Shaw, Industrial Gas Engineer of the City of Leicester Sub-Division, East Midlands Gas Board. There was a good discussion, in which the Lord Mayor and many delegates took part. The Lord Mayor afterwards entertained the delegates to tea.

During the morning a display of coke and gas burning appliances was staged at the Market Street Gas Showrooms by Mr. W. A. S. Pask, Manager. The display included a showing of films and on exhibition was a model of the Stanmore system of whole-house heating from one source by Radiation Ltd. Two coke-burning heating appliances were in operation and the view was expressed by delegates that such demonstrations, open to the general public, would do much to stimulate enthusiasm for smokeless methods of domestic heating.

North West

The North West Division held a joint meeting with the Institute of Fuel on November 9th, in Manchester, at which Mr. W. F. Howells presented a paper on "Industrial Gas in the Manchester District."

North East

A sub-committee of the Executive Committee of the Divisional Council has made a report based partly on an examination of the returns from the area in the Society's "Survey of the Sources and Incidence of Atmospheric Pollution." They have recommended a series of proposals towards a common policy to be pursued in the North East for the elimination of smoke. It is felt that, despite the valuable and efficient work of the local authorities, "individual action in the matter cannot satisfactorily root out the canker in this area, and it cannot be over-emphasized that it is by *concerted action* that satisfactory results may be obtained."

A conference of the Divisional Council was held in Durham on December 3rd, 1949, at which the principal speakers were Mr. Arthur Blenkinsop, M.P., Parliamentary Secretary to the Ministry of Health, and Mr. G. W. Tate, Chief Sanitary Inspector, Ashington U.D.C., who gave a paper on "Colliery Spoilbanks."

NEWS

FOLLOWING are the results of the Society's elections announced at the Annual General Meeting held in Harrogate on September 28th.

President: Dame Vera Laughton Mathews, D.B.E. (only nomination).

Hon. Treasurer: Sir Ernest Smith, C.B.E. (only nomination).

Vice-Presidents: All the retiring Vice-Presidents were re-elected.

Executive Council:

Scottish Division: John Innes, Allan W.

Ritchie, Bailie V. Robertson.

North West Division: Dr. J. L. Burn, Dr.

J. S. G. Burnett, S. N. Duguid, Charles

Gandy, W. L. Mather, Dr. C. Metcalfe

Brown, Professor F. E. Tylecote.

North Eastern Division: Alderman J.

Chapman, Alderman P. S. Hancock.

Yorkshire Division: John W. Beaumont,

Dr. I. G. Davies, J. Goodfellow, James

Law.

West Midlands Division: G. W.

Farquharson, Dr. W. R. Martine, C. A.

Stansbury.

East Midlands Division:

F. G. McHugh, A. Wade.

South West Division: G. W. Dhenin, F. R. Jefford,

F. J. Redstone.

South East Division:

R. A. Baskett, N. Bastable, H. G.

Clinch, S. R. Daly, Dr. R. Lessing,

J. J. Matthews, G. Nonhebel, Dr. A. J.

Shinnie, Stewart Swift.

★

Leyland, Lancashire, Urban District

Council obtained, on September 16th,

1949, the confirmation of the Minister

of Health for a Byelaw under section

104 (1) of the Public Health Act, 1936.

★

The United Nations permanent

buildings in New York, now being

erected, are threatened by disfigurement

from nearby smoking chimneys, accord-

ing to a correspondent writing to the

New York Herald Tribune. Three

chimneys of the Consolidated Edison

Company are alleged to be responsible,

and unless something more is done

towards smoke prevention "the out-

look for the international zone in the city is rather grim."



In the Soviet Union a battle against atmospheric pollution is in progress. Special gas and dust absorbing installations are being installed in factories, says *Soviet News*, and recently a Government decree was adopted prohibiting the ratification of projects for the construction of new, and the reconstruction of old enterprises, thermal power stations, iron and steel and other plants, if the said projects did not provide for special installations for preventing air, water or soil pollution. "New or restored enterprises can be only put into operation if passed by the State sanitary inspection attached to the U.S.S.R. Ministry of Health.



The British Electricity Authority state that a 50 per cent. reduction in grit emission has been achieved at the Fulham Power Station, about which in the last few years there have been many complaints.



Bristol Corporation are considering a scheme for district heating in the central shopping area. Work is in progress on the first part of Dagenham Council's Heath Park housing estate, in which will be incorporated a district heating system.



The Coal Exchange in London celebrated its centenary in October. In an article in *The Times* the growth of the coal trade in London is outlined, and the parallel increase in smoke is noted. The article ends: "As the coal supply grew in size, the grime on London increased, to the general indifference, until even St. Paul's, which has benefited so much from the coal dues, was held to look all the grander for the incense which the chimneys from the time of Wren had flung up every day from their foul and grimy censors. A different view of the evil of coal smoke is taken to-day, and

100 years hence the Coal Exchange, which is now celebrating its centenary, may have become just another historical relic of Old London, of value only to any Minister of Fuel and Power who is interested in antiques."



West's Gas Improvement Ltd. have kindly sent us a copy of an illustrated volume "Reflections and Reminiscences," by Sir Frederick J. West, G.B.E. This is a reprint of articles that have appeared in *West's Gas* and makes interesting and entertaining reading. Readers will agree that the story of "Jimmy's Apology" is a little gem.



The North Staffordshire Plan, prepared for the Ministry of Town and Country Planning by Sir Patrick Abercrombie and Mr. Herbert Jackson, has some strong words to say about the Potteries: "To a stranger, the urban scene of the Potteries is outstandingly one of smoke, dirt and industrial blemishes. A view from any high point looking down on the city of Stoke-on-Trent offers depressing proof. Whether it is as bad or worse than other industrial towns is impossible to say. But there is no doubt that it is very bad, and this quality gives rise to results which are worse. People who can afford to do so leave the towns. It is probable that the Potteries deserve the description of 'being a good place to get out of.' Those left behind are mainly of the poorer classes. Means are lacking to give adequate urban services. Poverty and decay breed further poverty and decay, and the grim pattern becomes more fixed. . . ."



The Secretary of State for Scotland has set up a committee to survey the Scottish peat bogs and to draw up a programme of research into the burning of peat in gas turbines for electricity generation.



"In preventive medicine there is no single step that would eradicate more

ill-health and inconvenience than would effective legislation against smoke." This is the conclusion of an article on "Smoke" in the September, 1949, issue of *St. Bartholomew's Hospital Journal*. Another quotation: "Why do millions flock to the West Country, turning the Duchy and the Principality into Trippers' kingdoms? Why is the West End synonymous with the Best End, and the Eastern railway system so much less efficient than the Southern; Surely it is because the wind blows generally from the west and south and collects in its passage the effluvium of a million chimneys."



R. H. ROWSE, B.Sc., F.INST.P., formerly Senior Principal Scientific Officer of the Fuel Research Station, has been appointed to be Director of Research of Smith and Wellstood Ltd.



A public inquiry was held by Mr. W. A. Damon, Chief Alkali Inspector, in London, on October 18th, 1949, on a draft order extending the list of noxious or offensive gases mentioned in the Act of 1906 and extending the list of scheduled works requiring registration under the Act.

The proposals extend the list of gases and fumes to include volatile organic sulphur compounds, fumes containing carbonaceous particles from black production works, and fluorine. Extended descriptions of works scheduled in the Act concern sulphuric acid works, chemical manure works, bisulphite works (to include works "in which oxides of sulphur are evolved in any chemical process") and cement production works (to include "works in which cement clinker is ground or cement is packed").

Additional works proposed to be included are black production works, fluorine works, and acid sludge works.

At the inquiry it was stated that the evolution of oxides of sulphur in a chemical process was not intended to refer to the combustion of fuel. Manufacturers of carbon black asked for its exclusion.

SMOKELESS HOMES



At Harrogate

DOMESTIC smoke had a fair share of attention at the Harrogate conference, and in particular it was the subject of Lord Simon of Wythenshawe's Presidential Address. Lord Simon is able to speak about it with unusual authority, for not only was he Chairman of the Advisory Council that produced the important "Domestic Fuel Policy" report—now usually called simply the Simon Report—but he was also a member of the Ministry of Health Committee under Lord Newton that examined the problem after the first world war, and made urgent recommendations for improved and smokeless methods of heating in the houses then being built. The Committee felt very strongly about it, and as Lord Simon said at Harrogate, their report was an admirable document. But, he added, "it is a lamentable fact that so far as action by the Government was concerned it might just as well never have been written."

To-day, however, Lord Simon agreed that one of the reasons we have for confidence that household smoke will steadily be abolished is that "at last the Government is concerning itself actively with smoke abatement." The other reasons for his optimism about the future were the need for fuel economy and for keeping down our fuel bills; the improved prospects for the conversion of bituminous coal to smokeless solid fuel; and the development of efficient and often attractive alternatives to the old-fashioned grate. "It is reasonable to say that in the battle against the old-fashioned open coal fire burning bituminous coal

victory is at last in sight." Some other quotations from Lord Simon's address are given on another page, and it will be found in full in the *Proceedings of the Harrogate Conference, 1949*, now being printed.

The Design of Appliances

The improved appliances for our homes were referred to by Dr. A. Parker in the course of his address to the conference on the work of the Fuel Research Station, of which he is Director. Many of the appliances are tested at the Station, where much research into domestic heating is in progress. An account of the new Calorimeter Building was given in *SMOKELESS AIR* No. 67 (Summer, 1948). In the discussion that followed a spirited and very sensible contribution was made by Councillor Mrs. Martin of Aireborough, who referred to herself as a domestic stoker. In fact, she said, there were 20 million domestic stokers in the country. They had heard of the attention being given to the training of boiler firemen in industry, but there was no such way to train the domestic stoker, who was blamed for so much of the smoke.

"The psychological appeal of the open coal fire," she declared, "is so strong that if the experts are going to educate us away from it they must provide something that is as good, if not better, in every way, and I do not think they are anywhere near that yet."

That, surely, is arguable. The new appliances are undeniably better in many ways, and the psychological attitude is one that changes with

experience and the gradual formation of new habits.

District Heating in American Houses

District heating for new housing estates is making progress, despite the difficulties of the present day that weigh so heavily against new and experimental projects. There are admittedly *cons* as well as *pros* to be considered, and the extent to which district heating can be developed is perhaps determinable only by actual full-scale experience. It was to observe district heating in practice, even though conditions were not identical with what they are here, that led the Ministry of Fuel and Power to arrange for a Mission on District Heating to visit the United States in 1947. It

was a small party of six experts, who visited 80 district heating schemes of different kinds and collected a vast amount of information. This has now been made available in a volume, *District Heating in American Housing*, published by H.M. Stationery Office at 4s. 6d.

In the United States district heating for houses has developed from the much older schemes for the heating of buildings in the centres and administrative districts of cities. The report points out how these central area schemes help to reduce the smoke nuisance: "highly industrialized Detroit, where 80 per cent. of the commercial buildings are connected, is astonishingly clean."

To a large extent the growth of district heating in housing estates is the result of the Federal Government



*District Heating in Poindexter Village, Columbus, Ohio
(From "District Heating in American Housing")*

coming into the housing field under the "New Deal" plans. Of 175 housing projects assisted by the Federal Housing Administration up to June, 1946, 123 were served by district heating. The Report points out an interesting fact of which note might be taken in connection with developments in this country :

"In the United States, the Government assists the finance of low-cost housing by meeting the deficit on annual running costs, instead of by capital subsidy. As a result, projects which, while requiring a higher capital outlay, will reduce running costs, seem to be more readily accepted than in the United Kingdom."

And again,

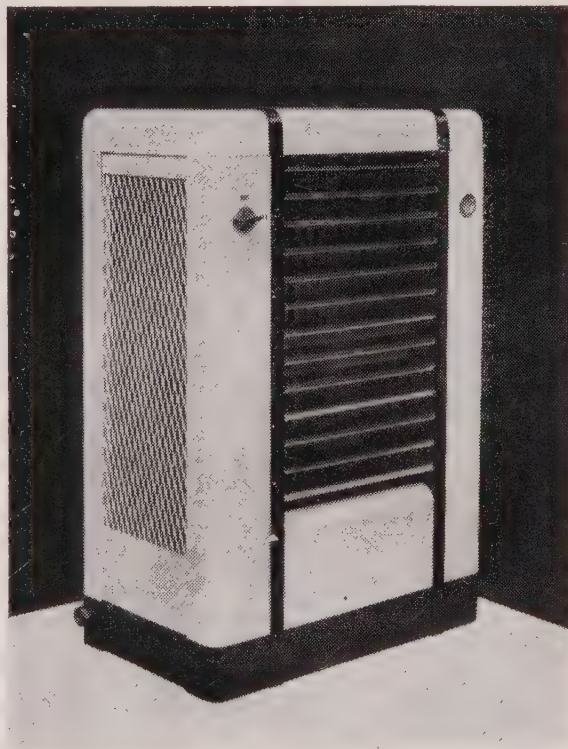
"It is the general practice of local housing authorities in the United States not only to provide tenants with shelter but to maintain a supply of heat, light, power and hot water. All these are regarded as public services in the United States, much as tenants in the United Kingdom look upon the supply of cold water. This applies whether space heating and hot water are provided by a district heating scheme or from separate plants in individual dwellings."

District heating, it is said, affords a greater measure of control over fuel consumption than is possible with separate dwellings, and there is clear evidence that district heating results in economy of fuel—substantial where the schemes are well designed.

An important point is that "the widespread adoption of structural insulation in the United States has greatly reduced the quantity of fuel required to maintain the standard of heating, but this is not a major factor in determining the choice of heating system there." American experience, therefore, "makes it clear that it would be folly to embark on district heating in this country without incorporating in the houses structural insulation at least to the standard recommended by the Ministry of Health."

A New Space Heater

Gas and electricity are married in a new space heater exhibited on the Gas Council stand at the recent Building Trades Exhibition at Olympia. It is the Sugg Assisted Convection Space Heater, which has been designed to give many of the advantages of forced circulation warm air heating without the complexity or capital cost involved in ducted systems.



The accompanying photograph shows the heater, which in this model stands 26 inches high and is finished in cream and black stove enamel, with acid-resisting stove enamelled louvres. Air is circulated through a gas-fired heat exchanger by a small silent-running fan, giving a positive but gentle warm air circulation, not to be confused with the high velocity air stream given by industrial unit air heaters. The heater gives an even temperature throughout the space heated.

Each unit will heat about 4,000 to 6,000 cubic feet of space, and multiple units are available for larger duties. The gas consumption is 32 cubic feet per hour and the electricity consumption 25 watts.

Smoke Inspectors' Case-Book

A further selection of records

8. *A Bessemer Case*

This is a recent form of aggravated nuisance that is causing much concern and as yet has not been remedied.

For many years the refining of steel has been carried out by the Bessemer process and the impurities have been blown to the atmosphere through an upcast shaft at a height of about 80 feet above the street level. The process is intermittent and an orange coloured smoke (ferrous oxide) is dissipated to the atmosphere for approximately eight minutes each hour. Though many approaches have been made to the manufacturers about trying some method of arresting or collecting this dust, the plea has always been made that the high discharge temperature and the finely divided particles of the dust make such an operation impracticable.

About 12 months ago it was noted that the density of the smoke from these converters had increased very considerably and that the emissions though of shorter duration were taking place more frequently.

Investigation showed that the process of refining was being accelerated by an oxygen enrichment of the air being blown into the converter and that the quantity of air which diluted the smoke

particles had been considerably reduced, thus causing a very dense brown smoke to be emitted.

A thorough investigation of the process by the specialists in this work has shown that it may be possible to hold about 75 per cent. of the solid matter in the smoke, but that the cost of such apparatus would be about £600 for each aperture.

It is understood that similar efforts to collect this smoke, which were carried out in Leamington Spa, have not proved successful.

A recent visit to the United States by a trade deputation has revealed that similar processes are controlled by a special process of cycloning and washing and the English branch of the company concerned are being communicated with, to see if such an appliance can be adapted at this works. In the meantime further investigation of the multi-cyclone method of arrestment is to be tried experimentally to try and mitigate the nuisance. The dust deposit in the vicinity of these converters is almost negligible and it would appear that such dust is carried a considerable distance before being deposited.

—J.L.

9. *Nuisance Abated by Persuasion*

Smoke emissions from the chimney of a large tannery had been consistently unsatisfactory for some time, in that volumes of dense smoke were emitted for long periods. One typical observation of this chimney showed that dense but not black smoke was poured out for $21\frac{1}{2}$ minutes during the half-hour's observation.

In this case it was thought preferable to get into touch with the principals of the firm to try to obtain a remedy by

negotiation rather than to take statutory action. The Managing Director of the firm was therefore approached and immediately brought out in defence particulars of the deteriorating quality of the coal allocated to them, which consisted of a mixture of opencast and deep-mined coal, and excused the unsatisfactory conditions on those grounds. It was ascertained during the interview, however, that this Director had no practical knowledge

of the condition of his boiler plant and on request he agreed to a joint inspection of the plant and a joint observation of the chimney's performance.

It was found that the plant consisted of two Lancashire boilers, each fitted with sprinkler-type mechanical stokers, but that only one of these boilers was in use. The steam demand on this was such that the mechanical stokers were being supplemented by hand firing. In an attempt to increase the output of this boiler a steam jet had been fixed inside each furnace tube to promote additional turbulence, and this and the steam blast forced draught, was operating at maximum pressure. It was also ascertained that the fireman was not regularly employed on this job, but that the work was regarded as being something that anyone who had nothing better to do could perform. The result of the combination of these conditions, and the heat and noise in the boiler house, was almost indescribable.

It was suggested strongly that experience would probably show that it would be more economical to work both boilers at optimum conditions rather than to force one of them, and after considerable discussion the management agreed to put both boilers

into commission. Our representations were greatly helped by the almost unbelievably bad performance of the chimney during the interview.

An immediate improvement was noticed, and subsequent visits showed that the reasons for this were as follows :

(1) Both boilers were in use.

(2) Mechanical stoking only was being used, supplementary hand firing being unnecessary.

(3) Better fuel had been obtained.

(4) Regular and more conscientious firemen had been obtained and were being kept on the job.

(5) The steam jets over the fire were no longer being misused.

More recent observations have shown that the improvement has been maintained. The management has been thanked for their co-operation, and now appear to be amenable to any suggestions which might improve matters. It is, of course, noteworthy that this very considerable improvement has been secured entirely by friendly negotiation and agreement between the two parties. It does appear that the method of direct approach has in this case resulted in appreciation of our point of view, a result which might not have been achieved by statutory action.—*J.H.W.*

10. The Case for Prior Approval

This report, relating to experiences in an industrial borough possessing no private Act for the "prior approval" of industrial fuel burning plant, indicates what can be done within the limits of existing statute law.

An inter-departmental arrangement exists whereby the Borough Engineer refers copies of appropriate plans of industrial and allied buildings to the Chief Sanitary Inspector for examination and comment.

Among the plans received was one from a firm proposing to carry out the recovery of lead, copper and zinc from scrap cables and other articles consisting substantially of non-ferrous metals. The present shortage of metals of this group makes such an operation

economically well worth while. In essentials, the process consists of burning off the combustible substances (usually rubber, gutta-percha or bitumen) by heating the material in an open pot furnace. The heating is continued long enough to melt the lead constituents after which the copper wire, then reasonably free from impurity is removed manually. Later the molten lead is cast into ingots. Experience in other parts of the country had shown that the removal of rubber and bituminous compounds by burning was necessarily accompanied by emissions of dense, and offensive, smoke. The scheme, as originally proposed, contained no provision for dealing with such smoke other than by discharge

from a tall chimney. Advice was given to the Borough Surveyor that this provision alone would not prove effective in dealing with the anticipated smoke nuisance and that, therefore, the scheme should be amended so as to incorporate the principle of destruction of the fumes by passage through a fire-bed. In the light of this advice the Surveyor told the applicant firm that, notwithstanding the industrial nature of the locality, the Town Planning Committee would not be likely favourably to consider an application for a factory engaged in the recovery of non-ferrous metals unless the process embodied the precautions recommended by the Chief Sanitary Inspector.

Consultation subsequently took place between the applicant and the town's smoke abatement officer as a result of which the original scheme was radically amended. The principles finally agreed upon were that (a) the plant should work entirely on coke or other smokeless fuel; (b) the melting pots should be cowled; (c) the flues from the cowls should be connected to the underside (i.e. ashpit side) of a coke-fired furnace;

and (d) if, in spite of the foregoing precautions, smoke nuisance still arose, such further modifications as the local authority might prescribe should be carried out.

In practice the process has worked well, no smoke of nuisance value having so far arisen. The principle of destruction of fumes by incineration is, of course, not new; it was envisaged even in the early offensive trade byelaws. For this process it is essential to have a fairly high stack in order to obtain sufficient draught and to disperse such residual smoke as is finally emitted from the stack. The plant in question was erected on a former factory site where there was a disused stack over a hundred feet high. A further plant has now been built in another part of the town and functions efficiently under natural draught from a brick stack only fifty feet in height.

The two prototype plants so far installed in the town indicate that this process may safely be permitted in areas zoned for heavy industry, provided that the basic principles referred to earlier are adopted. —E.B.

11. *The Story of an Underloaded Boiler*

A very old, dilapidated and much overloaded boiler had been replaced by a 30 ft. x 8 ft. hand-fired natural draught Lancashire Boiler to serve the needs of a laundry and dyers in my district.

She was warmed up for a few days and on Monday morning, the first day of the steaming run, clouds of black smoke rose from the chimney every few minutes as I approached the works.

On arrival I noted the fires were clean and took up a position in the yard where I could see both boiler front and chimney rim. Black smoke was emitted for about a minute after each firing round and then—hey presto!—it was gone without the slightest trace until the operation was repeated. The fireman was operating just as advised and opening and closing the door louvres regularly.

Taking closer view of proceedings

in the boiler-house I observed that dampers were full up, pressure was satisfactory at 60-65 lb., but most significant of all, the firebeds were never more than two inches thick. It had been like that all morning. The pump was gently ticking over.

Dampers were dropped a third, then a half, but with barely any effect on either the smoke or firebeds. Even exceptionally light firing caused black smoke.

How I would have liked some information on flue temperatures, CO₂ and draught, but no instruments were available. Seeking out the Engineer I enquired the maximum steam load, which he said was five to six thousand pounds. Knowing the boiler rating to be much in excess of that I asked permission to try out an experiment because in my opinion a lot of heat,

and therefore fuel, was being wasted. He agreed, but warned me that dyeing would commence in the afternoon. I assured him he need have no fears that steam would not be available.

Bricks from a stack in the yard were built loosely in the ash-pit beneath the dead-plate until half the pit was closed. There was an immediate improvement in the quality of the smoke. More bricks were added until three-quarters of the ash-pit was closed. The effect on the chimney smoke was remarkable. The "peg" began to climb and a decent firebed was being built up. Dampers were still fully open.

The Engineer was still doubtful of the outcome of all this and pointed out that the load was going off preparatory to lunch break, thus accounting for the increased pressure.

I promised to return in the afternoon and take my punishment if the works had stopped, but left instructions for the fires to be cleaned whilst the load was off.

Approaching the works some two hours later I noted slight smoke from the chimney and turning into the yard the screeching from the steam-filled boilerhouse was deafening. It originated at the blow-off cock. The Engineer and his staff were alarmed.

Glancing at the pressure gauge showing 92 lb.—8 lb. below blowing-off point—and at the water gauges which were below the pointer, I made for the damper controls on top of the boiler, lowered the nearest one by about a half but was prevented by steam from reaching the other. Back on the floor I asked for the pump to be speeded up, although the stroke had been lengthened since morning. Firing was eased and gradually the screeching and hissing died away, disappearing at about 78 lb.

The fireman assured me he had not changed his methods since I left him. The firebeds were a delight to see. The Engineer told me two of the three dyeing vats were in use.

I asked about the "blow-off" cock and was told it had only been roughly adjusted and would be properly set and tested at week-end.

Explaining that obviously the fire-grates were too big for the job I suggested they be shortened by two feet and the bridge brought forward. This was done the following week-end. There was still some heavy smoke after that and the grates were shortened a further six inches, but steam was scarce early in the day and a hurried reversion to the two feet blanket had been made.

The firebeds were now getting too thick and pressure was being easily maintained at 70-80 lb. I advised the fireman to go slower with his firing unless the "peg" fell sharply.

Normally that would complete the narrative, but not so in this case.

Being satisfied the boiler could be operated with only a little smoke I informed the Engineer of the fact. Proudly he told me the position would be improved when the balanced draught had been fitted up. This was the first I had heard of the proposal and expressed the view that it was not necessary at present, to which he replied "The directors want the best and are obtaining quotations." Naturally I did not wish to do anything which might prevent gratification of that wish.

About two months later, on passing the gate I saw the Engineer and two others at the boiler front, turned in and was introduced. They represented the firm who had advised the improvements and who were going to install balanced draught equipment and a new type of grate manufactured by them. The job was done at the first holiday break.

Some time later I observed black smoke again and visited the works. There was the new equipment in full swing, the grates had been changed and were now their standard length. Firebeds were almost touching the tops of the tubes. The steam raising plant was now the sole responsibility of a new man who was at another branch that day, but he was continually making tests and keeping records. In fact, the reason for his appointment was that coal consumption had increased by several tons weekly since the balanced draught, etc., was introduced and thev

were having similar trouble at other branches.

The name mentioned struck a chord in my mind. I enquired whence he came and—yes!— it was the same man who had advised the improvements and supervised their installation.

I said nothing more and the usual notice was sent.

About a week later, having noticed the smoke was no longer black, and wishing to talk with the new man, I called again. He was again at the other branch, but I noticed the fans were not working and the furnaces were again operating on natural draught. The fireman had been instructed to operate in this manner. Coal consumption had gone back to

normal—the fireman knew because he had to wheel it from the other end of the yard.

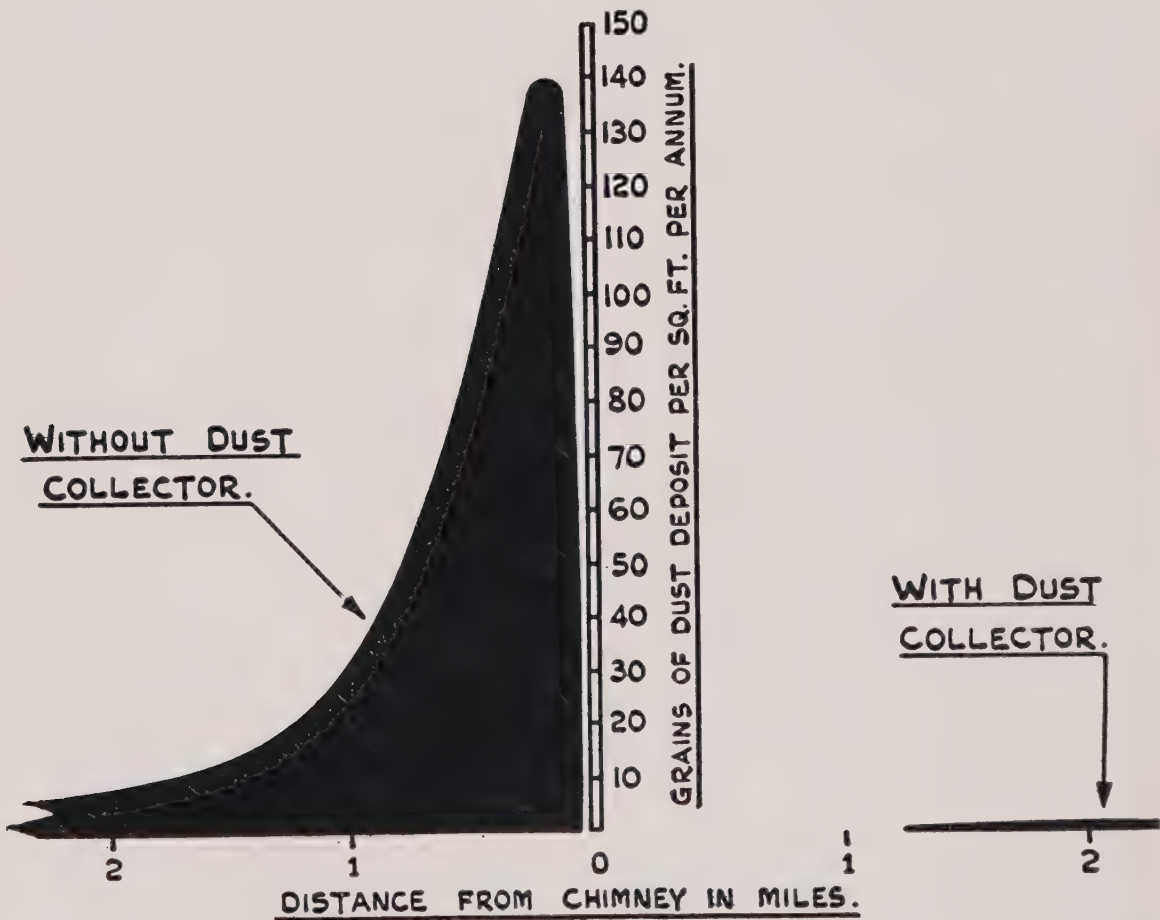
The smoke nuisance has disappeared, but I am still wondering why the balanced draught, etc., was installed. Anyway it will be there if it is ever needed.

The fact is, we are now back to the position as it was with the shorter grate, for the narrower spaces between the new bars have the same effect, i.e. reducing the draught at the grate and therefore admitting less excess air.

“Where there’s muck there’s money,” and apparently there’s plenty of it in the laundry business.

It’s a strange world.

—F.T.S.



Dust Collection.—This diagram is based on tests made by the Steam and Heat Institute of the Royal Swedish Academy for Engineering Research. The curves illustrate the amount of flue dust deposit around a chimney serving pulverized fuel fired boilers with (right) and without (left) a collector in operation. The chimney was 200 feet high, and the wind velocity $4\frac{1}{2}$ m.p.h. (Reproduced by courtesy of Musgrave & Co., Ltd., Belfast, makers of the Musgrave Aerodynamic Dust Collector).

Smoke Prevention Abstracts

122. Studies in Air Hygiene, Medical Research Council, Bourdillon, R. B. and others (London, H.M.S.O., Med. Res. Council Spec. Rep. Ser. No. 262, 1948, 356 pp., 7s. 6d.). This symposium consists of 44 papers grouped under four main sections: (1) Methods of sampling air for bacteria. (2) Air disinfection by chemicals. (3) Measurement of contamination of air by living organisms. (4) Transmission of air-borne infection in animal experiments.

123. Carbon Dioxide Recovery from Chimney Gases (Svenska Dagbladet; abstr. in *Chim., et Industr.*; and in *Chem. Tr. J.*, 1 Apl., 1949, vol. 124, 372). A large brewery in the north of Sweden has installed plant for the recovery of the carbon dioxide content of its chimney gases. The process was developed by the Stockholm Institute of Technology in co-operation with the "Stal" and "Separator" Companies.

124. Smoke Abatement: Current Practices and Regulations, American Municipal Association (Chicago: The Assn., 1948. Amer. Municipal Serv., Rep. No. 48-2, Repr. Ed., \$1; abstr. in *Bitum. Coal Res.* Jan. to Mar., 1949, vol. 9 (1), 12). This publication describes the progress of smoke control, summarizes existing ordinances in 46 cities, and by cities, lists the officials in charge of smoke control and provides a check list of ordinance provisions.

125. Residential Heat Pump in New England, Coogan, C. H. (New York; Edison Elect. Inst. 44 pp.; abstr. in *Heat. Pip. Air Condit.*, Feb., 1949, vol. 21, (2), 110). This booklet, the results of two years' study, presents data obtained from an experimental direct-expansion shallow ground coil heat pump system. Illustrated with diagrams, charts, micrographs and photographs, it gives detailed studies of the properties of the soil and earth. The conclusion is that the ground coil

appears feasible as a heat source for residential heating, six feet being the most desirable depth, and that a properly installed coil should last for years without deterioration.

126. Proposal for Underground Storage of Heat as Hot Water, Gregorig, R. (*Schweiz Bautzg.* 30 Oct., 1948, vol. 66, 599-604). A Swiss scheme for storing industrial waste heat, or surplus electrical energy as heat, in the form of hot water in underground basins: the latter are to be formed from existing natural basins by improving thermal insulation and isolation from underground streams by injection with clay. Hot water accumulated during the summer would become available during winter for house heating, etc. Temperature drops of the order of 10 deg. C. during storage are envisaged.

127. Smokeless Fuel Production (*Compressed Air Mag.*, New York, Sept., 1949). Describes a process for the fluidization of coal by passing air and gases under pressure through a bed of pulverized coal in the presence of high heat. Hydrogen, carbon and other gases are released and drawn off with the tar, leaving a solid mass of so-called char. This fuel is said to be ideal for home and domestic use, burning with minimum of smoke. The process has been developed by Dr. A. D. Singh. The Illinois State Commission has supported the project and has completed plans for the construction of a pilot plant with a capacity of 2 tons an hour.

128. Reduces Foundry Smoke (*Iron Age*, U.S.A., 9th June, 1949; abstr. *McGraw Hill Digest*, New York, Aug., 1949). Small brass foundries can reduce smoke and air pollution by using finely ground silicate material as slag on surface of molten metal. Preliminary results of experimental work indicate that slag crust will substitute for bagging equipment.

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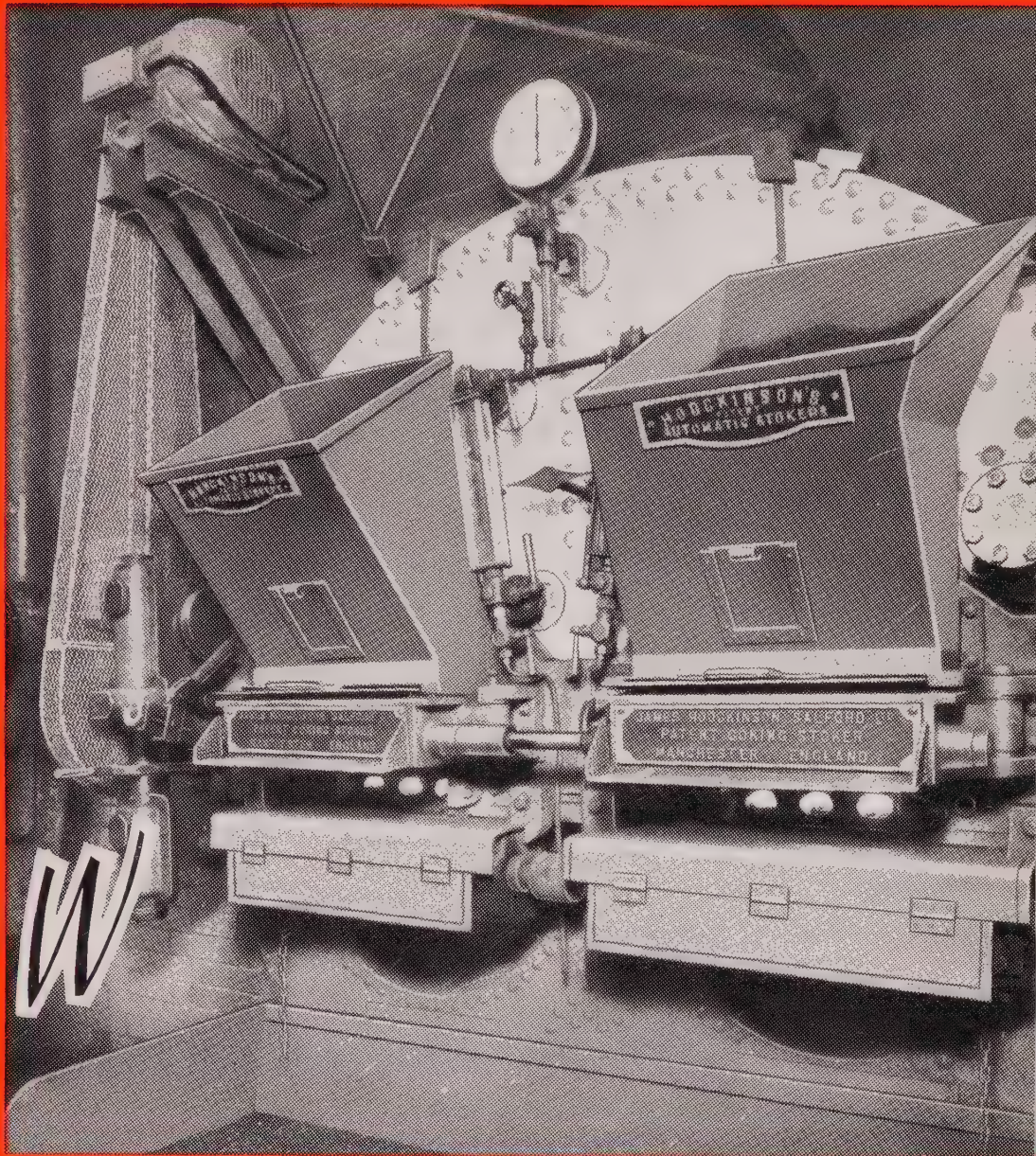
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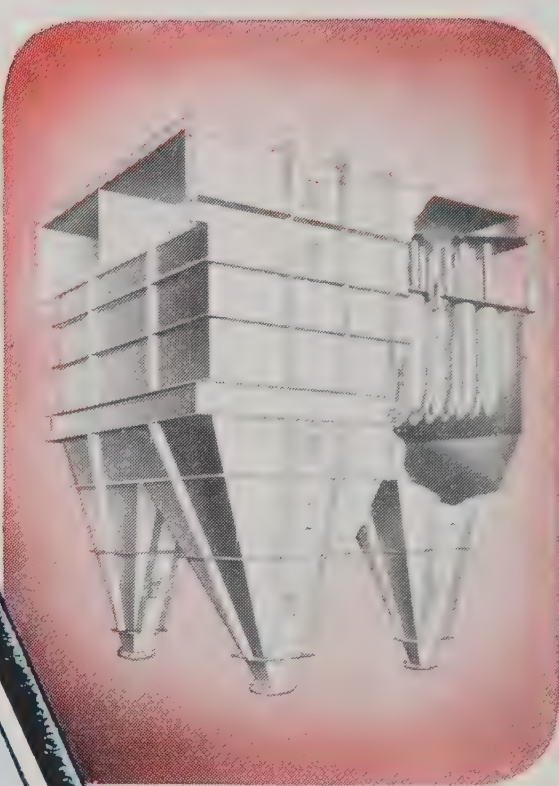
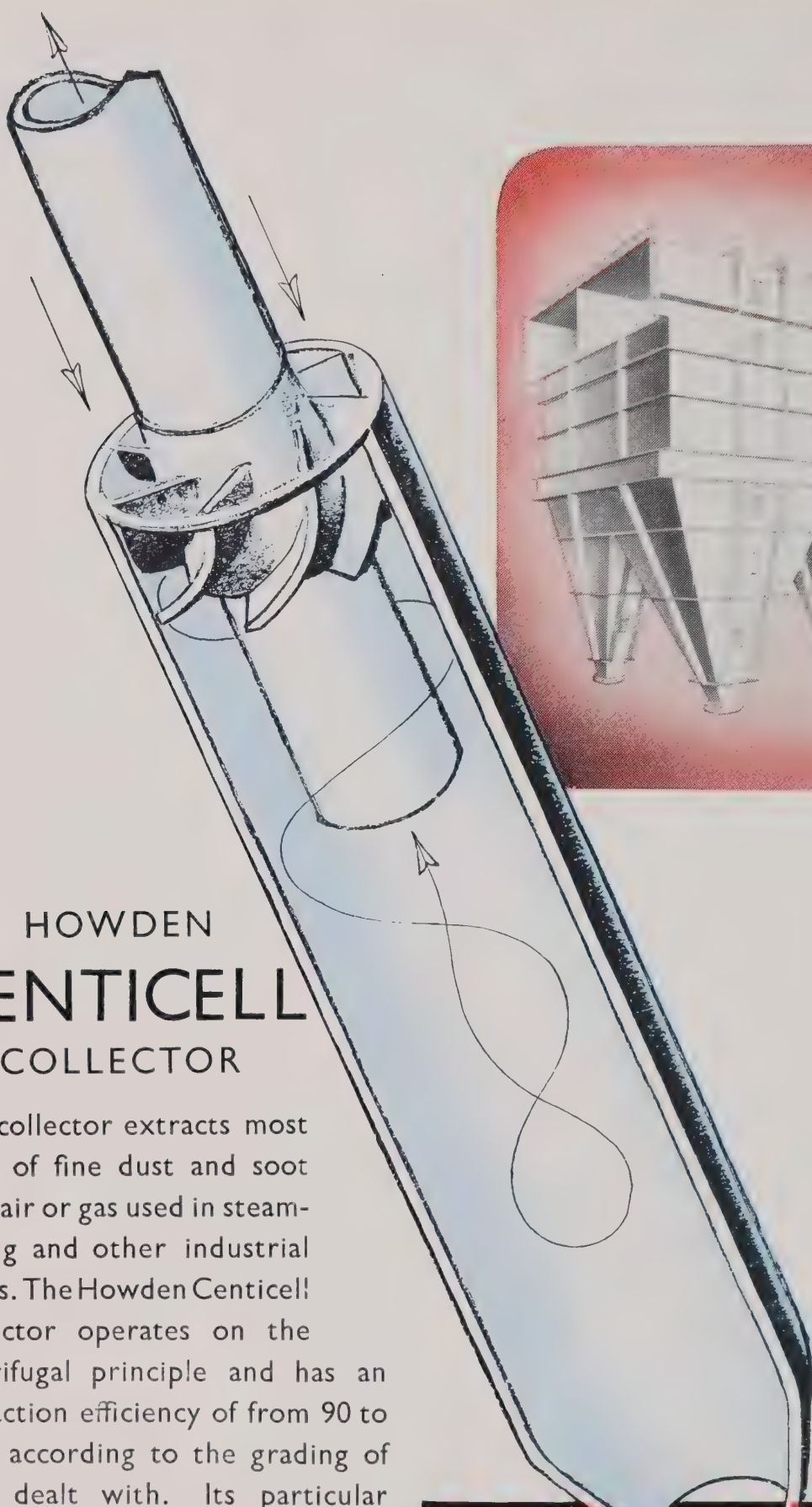
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 73

SPRING

1950

ONE SHILLING

In this Issue

The Society Comes of Age

Report on Donora

Dr. Bronowski on "Fog"

Railway Locomotive Power



GIVE UP SMOKING?

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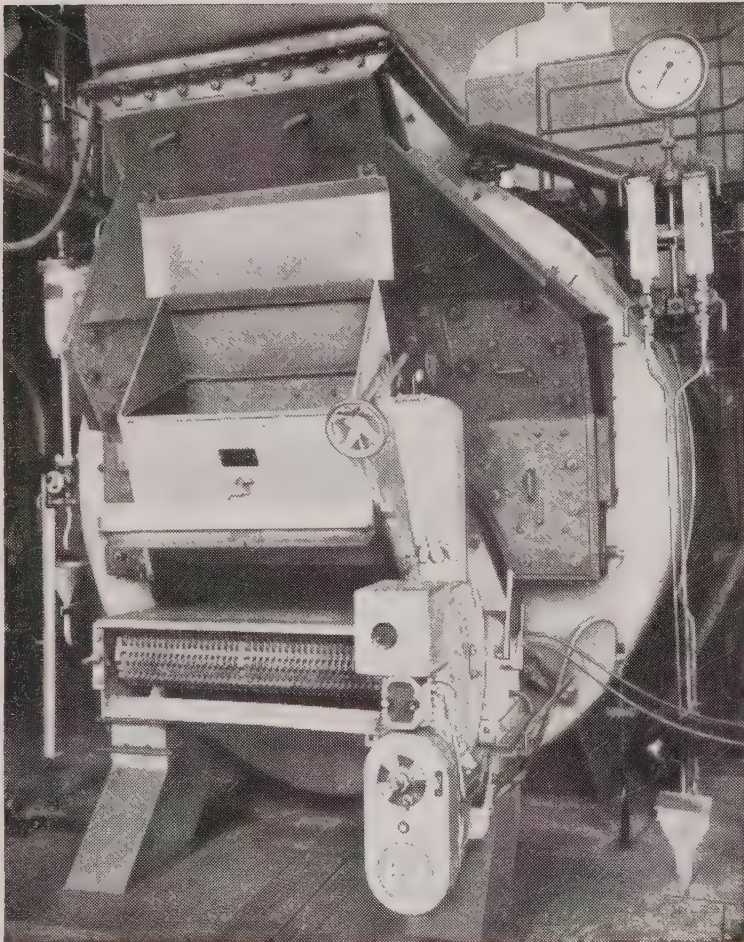
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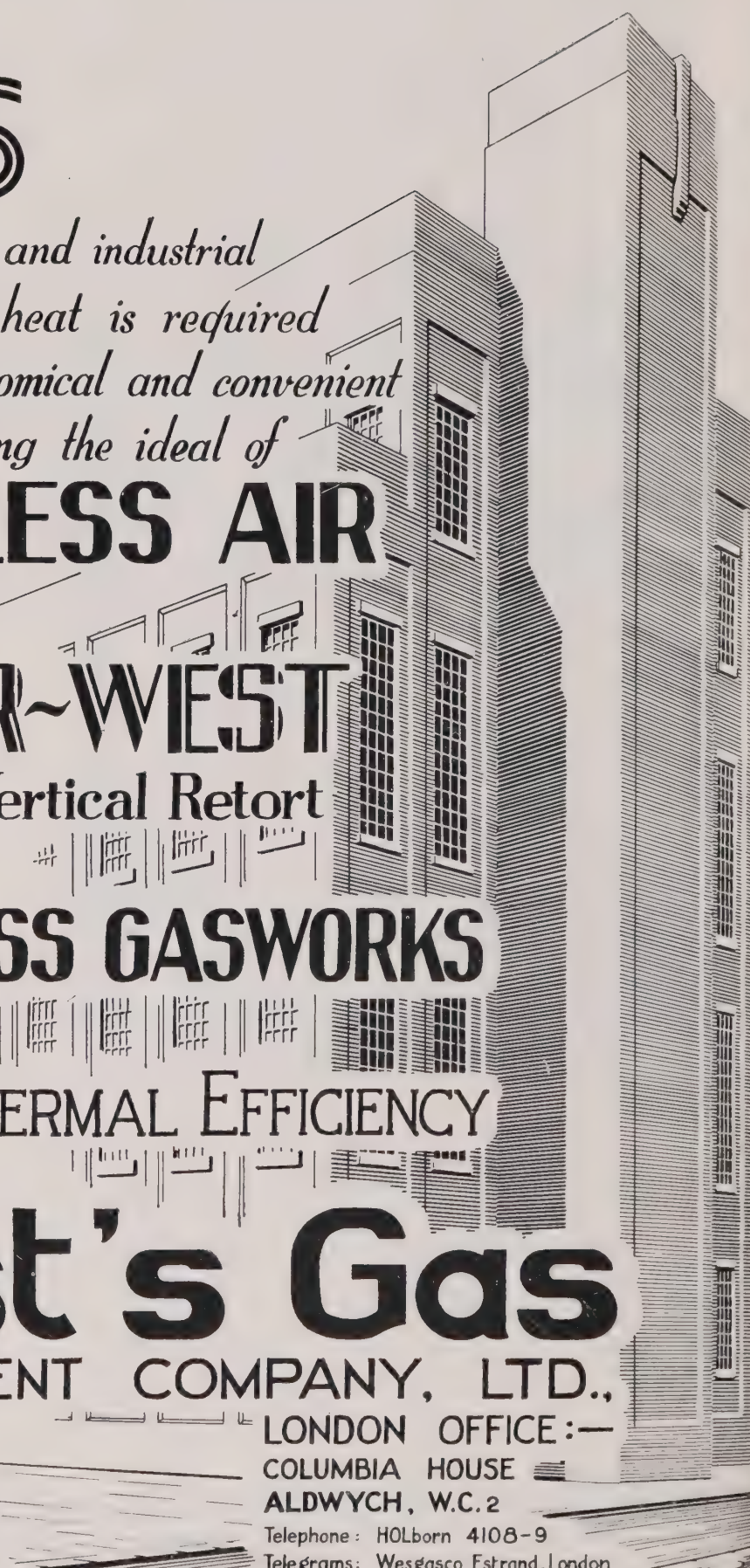
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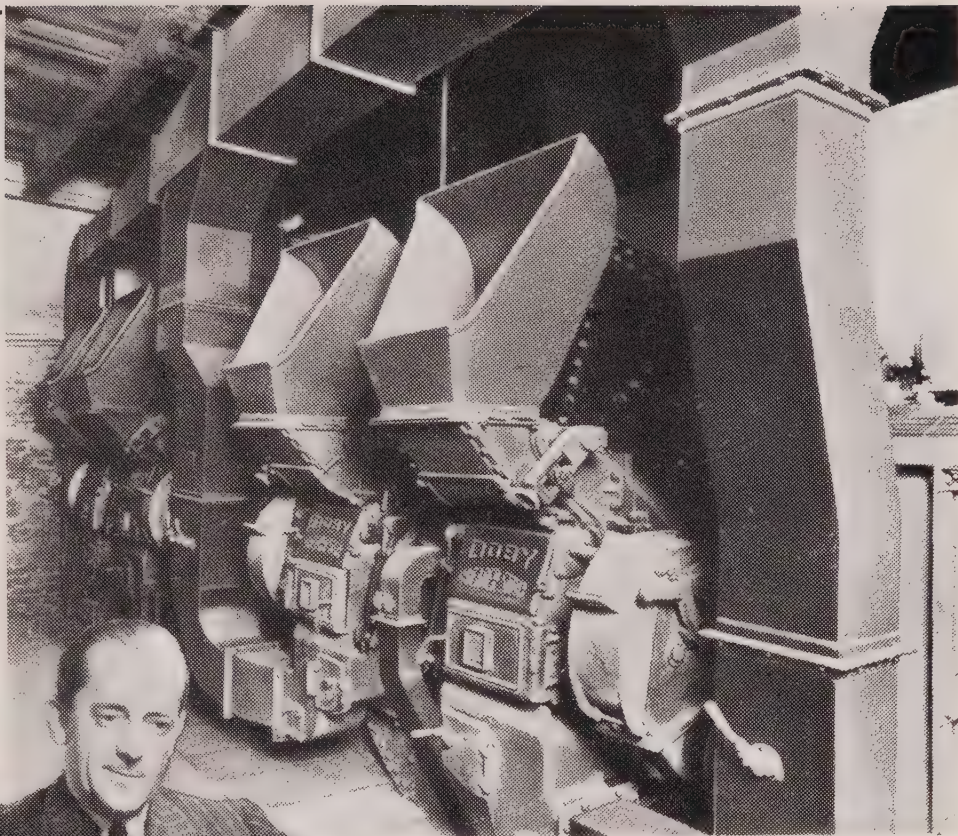
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SMOKELESS AIR

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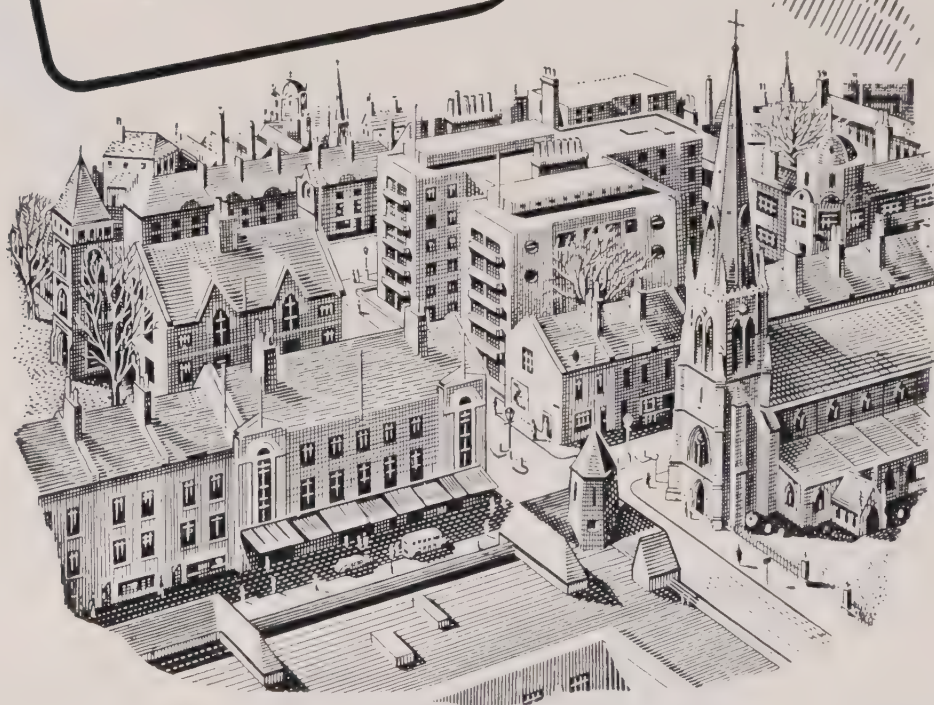
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Divisional Councils and Honorary Secretaries :

- SCOTTISH : John Traill, B.L., City Chambers, Glasgow (Central 9600, Ex. 220).
- NORTH-WEST : H. Moore, Health Dept., Town Hall, Manchester (Central 3377, Ex. 339).
- NORTH-EAST : William Gray, M.R.San.I., Health Dept., Town Hall, Newcastle-on-Tyne, 1 (28520, Ex. 271-2)
- YORKSHIRE : James Goodfellow, M.R.San.I., Health Dept., 12 Market Buildings, Vicar Lane, Leeds, 1 (30211, Ex. 11).
- EAST MIDLANDS : Alfred Wade, M.B.E., F.R.San.I., Health Dept., 50 Shakespeare St., Nottingham (40584).

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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

The Next Conference

JUST as the last stages of the Harrogate conference were being completed—the issue of the volume of *Proceedings*—the preparations for the 1950 conference were beginning in earnest. This year the Society is to visit Margate, by invitation of the Mayor and Corporation, and, in the opinion of those who have attended other conferences recently in this bracing and hospitable resort, a wise choice has been made. We know that some of our readers will raise their eyebrows a little, and may tell us that it would be more appropriate if the Society met in one of the smokier cities, where we could both see examples of what we were discussing and encourage local interest and activity.

Until 1939, of course, the Society did

meet in such cities, but it is now quite impracticable to do so because of the greatly increased number of those attending. Few, if any, of the provincial towns, other than the health resorts, can provide appropriate and conveniently central mid-week accommodation for 500 or more people. Even the resorts are ready to welcome us only out of their “season.”

Birthday Party

The programme for Margate will be given in our next issue, and details will as usual be sent to all members and representatives. We may mention, though, that the opportunity will be taken to celebrate the Society's 21st birthday during the conference—an occasion for which this and the next number of *SMOKELESS AIR*, as will be seen, are providing a prologue.

Exhibition in Manchester

In the article on the Society's "Coming of Age" will be noted references to exhibitions in Manchester and Birmingham in 1924 and 1926. These were organized for, or under the auspices of, the Smoke Abatement League by Provincial Exhibitions, Ltd., of City Hall, Manchester. Another such event was staged for the Society in the same way in 1930. Plans are now being made for a similar type of exhibition, again to be in the City Hall, Manchester, in November of this year. It will be organized by Provincial Exhibitions, Ltd., under the auspices of the Society, and although smoke abatement will be implicit throughout, the emphasis will be as the title indicates, "Fuel Efficiency in Industry and Home."

Much interest has already been shown by the fuel and appliance associations and firms, and there are good prospects for a show even more comprehensive than those in the past. It will be designed to be of interest to those who use fuel in industry, commerce and administration, and in the home. More information will be given in later issues, but in the meantime particulars of space and stands, etc., can be obtained from Mr. B. Maxwell, Provincial Exhibitions, Ltd., City Hall, Deansgate, Manchester. (Tel.: Deansgate 6363).

President Truman on Smoke

Readers may have noted how much more news of events in the United States have been reported in these pages of late. Smoke prevention is more and more coming to the fore in that country, and the Donora disaster—the important Federal report on which is reviewed at length on later pages—has still further stimulated concern and action. This will go much further now, it can be surmised, as a result of the following letter from President Truman to the Secretary of the Interior, which because of its special importance we record in full:

*The White House,
Washington.
December 10th, 1949.*

"My Dear Mr. Secretary:

"The contamination of the atmosphere and its potential adverse effects on health, industry, agriculture, and natural resources are causing wide concern. The agencies of the Federal Government are being called upon to assist private, state and municipal interests in finding a solution of air pollution problems.

"During the past few months, the interested Federal agencies have conferred informally on various aspects of this problem. It is my desire that these activities now be officially organized and that efforts be directed toward summarizing our present knowledge of this difficult subject. Recommendations should be prepared for cooperative effort of public and private interests to minimize atmospheric pollution and its ill effects.

"I am requesting you to organize an Interdepartmental Committee which will, in turn, sponsor a United States Technical Conference on Air Pollution. I am requesting the heads of the interested departments and agencies to provide you with the names of the representatives from their agencies whom they desire to serve on the Committee. The Federal agencies should present at this Conference information available to them bearing on this problem. The most highly qualified persons in this field in industry, Government research institutions, and other lines of endeavor should be invited to participate, and a report summarizing the findings of the Conference should be made available to the public. I do not contemplate that the deliberations of the Interdepartmental Committee and the Conference will result in the creation of programs which will commit the Federal Government to material expenditures from an already heavily burdened treasury, since the responsibilities for corrective action and the benefits are primarily local in character.

"Sincerely yours,
Harry S. Truman."

Since SMOKELESS AIR is the only journal in the world concerned solely with atmospheric pollution we shall continue to do our best to keep readers informed of all events and developments in the U.S.A. and Canada (where there is a similar new growth of activity). This may, in fact, become more and more an international journal of smoke abatement.

A Super Dust Collector

In the Winter, 1949, issue of *Howden's Quarterly*, the very readable house organ of James Howden and Company, Ltd., a firm that has done much to help to prevent smoke in industry, there are two short articles on "Smoke." One of the authors, Mr. F. L. Robson, has something new and delightfully fresh to say about the subject: "It may be interesting to add," he writes, "that the respiratory system of the average human being represents a most efficient dust collecting and gas washing system. The nose acts as an irrigated filter, whilst the throat passages to the lungs act as ducts with bends and baffles coupled with an irrigated lining. Finally, the lungs themselves would appear to represent a very efficient baffled settling chamber with an absorbent wall. The lungs themselves are capable of collecting dust down to less than half a micron (that is a fifty-thousandth part of an inch diameter) but I am not sure of their overall efficiency of collection."

Smoke Over Northolt

How often has the Society, basing its evidence on the findings of airmen themselves, stressed how smoke adds to the cost and danger of flying operations. Now comes a further story to add to the indictment. It appeared in the London *Evening News* of November 24th, 1949. "Passengers flying to Britain from the continent," wrote the correspondent, "are having their plans upset by housewives building up their fires on the cold winter days.

"Smoke from the fires drifts over Northolt Airport, and sometimes causes

incoming airliners which have flown from fair weather, from as far away as Athens, to divert to other airports when over the London area. This fact has been proved over a number of years by the Met. Staff at Northolt Airport."

Said one of the Met. officers: "There is a distinct deterioration in visibility every winter day between 9 and 10 in the morning and 4 and 5 in the evening. Even on a clear day, when generally visibility is between 10 and 15 miles, drifting smoke from nearby houses causes it to drop to between 600 and 1,000 yards on the airport." Even during recent foggy weather, it was said, planes would still have been able to land at Northolt had there not been smoke from nearby chimneys to make visibility worse.

Is not this a clear case for creating a smokeless zone around Northolt? It could be done!

Puzzle Corner

We were recently intrigued to see that the anagram puzzle in an evening paper was the title of one of the Society publications. The reader was required to shuffle into a new word the letters of
NO CLEAN CITY

No prize is offered for the first correct solution, or anything like that, but we will give the puzzle-minded a clue to the answer—it is, curiously enough, often a contributory factor, especially in the winter time!

The Scottish Division of the Society is to hold its first two-day annual conference in Aberdeen in June. One of the speakers will be the Society's President, Dame Vera Laughton Mathews.



The North East Division will hold its annual meeting in Middlesbrough in June. Early meetings of the Yorkshire Division in Stocksbridge, and of the East Midlands Division in Chesterfield are being arranged.



The Society's Annual Report, with accounts, subscription lists, and other information is now printing. All members will receive a copy and we shall be glad to send one on request to other readers.

THE SOCIETY COMES OF AGE

1929-1950

THE National Smoke Abatement Society was born in Buxton twenty-one years ago, when a joint conference of members of the two bodies decided to amalgamate the Coal Smoke Abatement Society, of London, and the Smoke Abatement League of Great Britain, which worked from Manchester.

The Coal Smoke Abatement Society had been formed in London in 1899, and thanks, one believes, more to the personal efforts of its Treasurer, Dr. H. A. Des Voeux, and its Secretary, Lawrence Chubb, than to its small membership and tiny income, had after thirty years of uphill work succeeded in making smoke abatement regarded not as the dream of impractical visionaries, but as something serious and even—in good time—possible.

Later, Chubb and Des Voeux were the main organizers of the effort to obtain effective new legislation that, though partly frustrated by both industry and the Government, led to the passing of the Public Health (Smoke Abatement) Act, 1926. After this, with Des Voeux retiring from London practice and Chubb (later to become Sir Lawrence Chubb) having more and more to devote his time to his great work for Commons and Footpaths Preservation and the National Playing Fields, the Society became less active and its small membership dwindled.

In the north, during the early '20's, the Smoke Abatement League, first formed in Sheffield in 1909, had been revived, mainly by a group of Manchester people—at first by E. D. Simon (now Lord Simon of Wythenshawe)



The First Presidents

Dr. H. A. Des Voeux
1929-43

Will Melland
1943-45

Sir George Elliston
1945-48

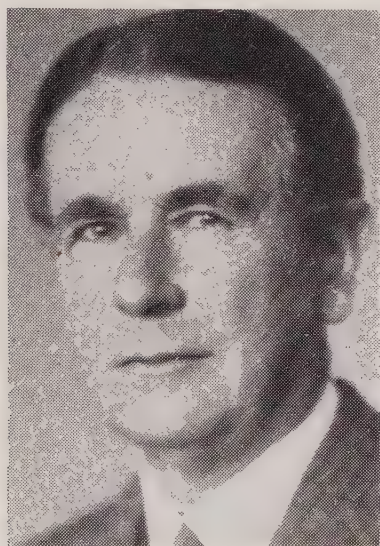
and Principal Graham of Manchester University, and later largely by Will Melland, a member of the City Council and supporter of many worth-while causes. They obtained the support of a handful of progressive local authorities, and a few keen individuals, and joined forces with the Scottish Smoke Abatement League, working under the leadership of W. Brownhill Smith of Glasgow. In 1924 and 1926 successful smoke abatement exhibitions and conferences were held in Manchester and Birmingham respectively, and there were signs that if the effort could be maintained the League might be built up into a body of some influence. In 1928, faced with the resignation of its honorary secretary, an unpleasant bank overdraft, and grave doubts about future income, the League boldly decided to engage a whole-time paid secretary. (If that secretary may interpolate a personal note, it was mainly the high regard he had for the wisdom and integrity of Will Melland that induced him to take on a job that promised much interest but even more risk).

With a small, keen Committee, Will Melland as both Chairman and Hon. Treasurer, the staff of just one (for at first not even a typist could be afforded), and a small back room, the League began to make progress, and

within a year, after talks with its London friends, it was agreed to amalgamate with the Coal Smoke Abatement Society. Headquarters and centre of activity remained in Manchester, but at Buxton Dr. Des Voeux was justly elected President, Lawrence Chubb became Hon. Advisory Secretary, and Will Melland continued as Chairman and Hon. Treasurer.

It is interesting to look at a group photograph taken at Buxton during that inaugural conference, where 34 people were assembled, compared with the 450 of our present day gatherings. Few of those in the group are still active members, but there are Dr. and Mrs. E. W. Smith (now Sir Ernest and Lady Smith), Mr. Sidney N. Duguid, now Vice-Chairman of our Technical Committee, and Mrs. Duguid, Miss Irene Cooper, one of the earliest individual members, Mrs. Millicent Jast, Bailie Munro of Glasgow, Dr. J. R. Ashworth of Rochdale, J. W. Beaumont of Halifax (now Deputy Chairman), Councillor (now Alderman) F. W. Perry of Smethwick, and the writer.

Dr. Des Voeux died in 1943, still President, and Will Melland, alas, is now an invalid and no longer able to take any part in the work that owes so much to the skill and devotion he gave to it



**Lord Simon of
Wythenshawe**
President, 1948-49



**Dame Vera
Laughton Mathews**
*Elected President,
September, 1949*



Sir Ernest Smith
*Committee Member
from 1929; Hon.
Treasurer from 1948*



Charles Gandy
*Committee Member from
1929; Chairman from 1934*



John W. Beaumont
*Committee Member from
1929; Deputy-Chairman
from 1946*



Dr. R. Lessing
*Council Member (Coal Smoke
Abatement Society) from 1909
and of the NSAS from 1929.
Now Chairman of the Technical
Committee*

in those early days. He continued as Chairman until 1934, when he was succeeded by another Manchester man, our present Chairman, Charles Gandy, and as Treasurer until 1943, when he followed Des Voeux as President.

Among the retired members of the Executive Committee's first critical years mention must be made of a few whose services should not be forgotten. Still closely associated with the Society are Miss Marion Fitzgerald, who wrote, lectured, and advised in very many ways, Mrs. Jast (who read a notable paper at a later conference), Dr. J. R. Ashworth, who did much important pioneer work on the scientific study of atmospheric pollution, Alex Munro, R. Veitch Clark, Manchester's M.O.H., Johnstone Jervis, M.O.H. of Leeds. Morton Rowe, the Manchester Smoke Inspector (a great help to a raw young secretary) is dead, and so is R. H. Clayton, one of the few industrialists who understood how smoke injures business.

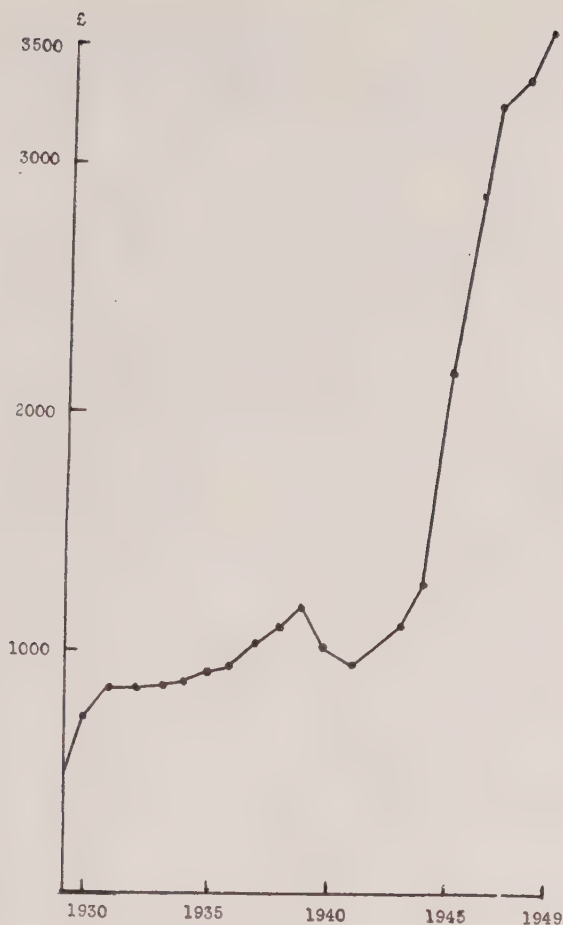
Some High-Lights

This is not the place for a detailed history of events, and we need mention only a few that stand out in those first 21 years. The first came in 1930, a year after Buxton, when for the first time a local authority officially invited us to hold the annual conference in its

city, where a civic welcome was given by the Lord Mayor. This, to Dr. Des Voeux in particular, marked a new epoch; for he remembered only too clearly the apathy—and even derision—that had met his early efforts to impress upon local authorities that smoke prevention was their responsibility. It was the city of Leicester that set the example that was to be followed, without question, in each succeeding year.

Next in importance was the exhibition at the Science Museum, South Kensington, in 1936. This was arranged jointly by the Society and the Museum authorities, and for the first time gave the opportunity for intimate co-operation with many scientific and industrial organizations. The exhibition, naturally with its emphasis on the scientific and technical aspects of the subject, was a great success and markedly increased the Society's prestige, especially in London. It was a step towards the recognition being sought to have the exhibition opened by the then Minister of Health, Sir Kingsley Wood, and the conference held in conjunction with it opened by the Secretary for Mines, Captain Harry Crookshank.

The consequence was that the following year, headquarters were moved



The Struggle for Funds

The graph shows the steady annual rise in membership subscriptions, the only falls being in the first two years of the war. These figures are less than the gross income, which at present is not meeting expenditure—last year the deficit was £700.

from Manchester to London. Progress began to quicken, and the omens for much bigger advances were good when first the Munich crisis, and then the shadow of 1939, began to darken the scene, and when war did come it seemed at first that the efforts of the ten years' unbroken development were likely to be lost.

But the Society managed to keep in being during the war years, and most of its members stood loyally by it. There seemed to many to be little purpose in discussing smoke abatement during a war, especially when smoke production was being encouraged, but almost from the beginning this journal began to stress smoke prevention as a factor in fuel economy, to urge a National Fuel Policy, and the establishment of a Ministry of Fuel and Power.

It began to discuss the problems of post-war reconstruction and the great opportunity they would afford for smoke prevention. As early as 1941 the Society submitted an interim memorandum on these matters to the Minister of Works and members of the Government concerned with post-war planning. A more detailed memorandum followed, and then one on smoke prevention in post-war housing.

Until 1943 no meetings or conferences were held—and hardly even a Committee meeting—and it was through the discussions and reports in *SMOKELESS AIR* that survival was ensured. From 1942 onwards interest began to re-awaken, and in many respects soon exceeded the pre-war level. In a score of different ways the Society was able—and often was obliged—to extend its activities. New members came in, including many hitherto lukewarm local authorities, and by 1945 a new constitution was needed. Under this subscriptions were increased, a more complex system of Council and Committees was set up, Divisions were created. The annual income recovered from its wartime drop just in time to make it possible to meet the new situation without visible embarrassment. Conference attendances rose from the 100 or 150 of the '30s to a steady 450, and the flow of



Growth of Annual Conferences

Showing numbers attending each year. Even the biggest pre-war event—Science Museum, 1936—was less than half the size of present day conferences.

information relating to the problem coming from both home and overseas grew remarkably in volume and interest, so that to-day it would be a full-time task to sift, digest and record it all as we should like. In short, compared with before 1939, the Society had taken a long stride forward.

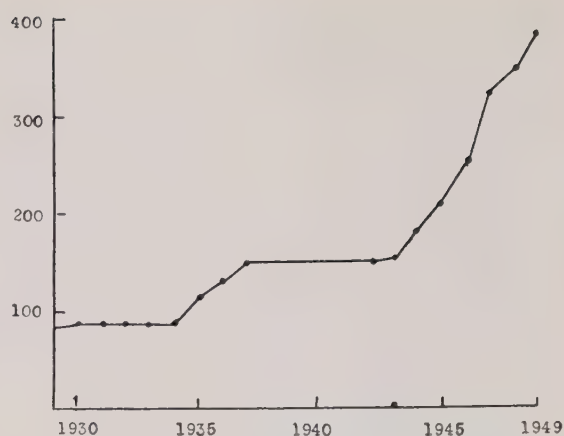
What has been done?

How much has the Society's progress been due to its own earlier exertion and influence, and how much is the result of cashing in on circumstances that would in any case have arisen? It is a difficult and intriguing question, and one that can never be fully answered. But the more the past years are considered, in their right perspective, the more certain it seems that the Society has had a profound and lasting influence on the shape and position of smoke abatement to-day. It has done much, if not everything, to link smoke abatement with the fuel efficiency drive, and with the demand for better-heated, cleaner homes, and with town planning. Although smoke abatement might in any event have been remembered and dealt with in these and many other questions, it is probable that it would have been vague, disconnected, and only too easily overshadowed by other things.

Perhaps the biggest contribution to the recognition that smoke abatement now enjoys (still limited though it is) to be made by the Society is due to the simple fact of its continuously active existence over many years. Though not powerful enough to carry through spectacular campaigns, or to gain its objectives by direct assaults, its very persistence and patience, its constant reiteration of the smoke abatement theme, and its insistence that smoke abatement should not be overlooked or forgotten, have gradually built up a widespread awareness of the problem and an almost complete, though often still hesitant, acceptance of its case.

A Right Start

Looking back, there is little in the broad lines of policy initiated by the Society's first leaders that, in the event, one would have wished otherwise.



How Local Authorities are Joining Up

*Showing the numbers affiliated year by year.
The graph speaks for itself.*

The alliance with local authorities has been immensely fruitful; the acceptance of support from commercial interests (at first refused and then accepted only with misgivings) has been invaluable and has never been abused; a care that propaganda must be backed by sober data; an emphasis on realism in all advocated policies—all these have helped, and although with more hot air and glamour the Society might have made more of a stir from time to time, it would in the end have got it nowhere, and its prestige, instead of steadily rising, could only too easily have been lost.

On one important aspect of its work the influence of the Society seems to have been greater than is generally realised. It began forcefully to criticise the old-fashioned coal fire, and the wasteful use of bituminous coal generally, as among the main causes of smoke, and to demand more modern, smokeless, heating in the home at a time when to condemn the extravagant use of coal was a dangerous thing because it might reduce the amount of coal being mined. The coal trade, mine owners and merchants alike, reacted strongly to this, and sought to defend the coal fire and to belittle smoke abatement. More often than not the Society would be engaged in half-a-dozen newspaper controversies at a time with the coal trade publicists—a lively period that helped immensely to make the Society and its case better known.

in both contents and appearance. This journal, of which this is the 73rd number, has, despite its limitations of size, been one of the most valuable of the Society's enterprises: keeping members in touch and informed, bringing in new members, finding its way into libraries and reading rooms, being widely quoted and building up a useful record for future reference.

Although so far we have not reached the final stage of being able to point to where there once was smoke, saying, "There, thanks to the work we have done, is smokeless air," the Society can claim that it has done a vast amount of the essential preliminary work. It has initiated new ideas, of which that of smokeless zones, conceived by its Chairman, Charles Gandy, in 1935, is perhaps the most distinctive, and which is now to be found in a number of Parliamentary Acts. We cannot claim to have originated what we now call prior approval, for that is a principle that has been successfully established for many years in other countries, but we can say that without the Society it is probable that here the idea would not yet have even come on to the agenda for discussion.

One could continue—but our older members will remember, and others can only fully appreciate by reading back at some length—how, little by little, despite the ever-present frustration of the almost empty pocket, the Society has put smoke abatement on the map as a problem of national importance, of both social and economic significance. Only by looking back over the past 21 years can the distance traversed be appreciated: and, moreover, only by so doing (and there lies the real purpose of looking back), can we appraise the distances and the difficulties of what still lies ahead. It is a comparison that can give great encouragement, but by no means complacency.

[It is hoped to include in the next issue some messages and comments on the Society's "Coming of Age". We shall be very pleased to receive brief notes from any of our members.—Ed.]

NEWS

EXPERIMENTS on the underground gasification of coal at a site near Chesterfield are being carried out, and progress is reported to be very satisfactory. It is hoped that some gas will be produced this year.



Coventry Corporation has given notice that the provisions of the Coventry Corporation Act, 1948, relating to a smokeless zone in a central area of some 30 acres will come into force on March 1st, 1951. It is the area of Coventry devastated by enemy action, where already many of the premises conform to the desired practice. The smokeless zones proposed for Salford, which would have affected 5,000 houses and a small number of industrial premises, have had to be postponed. The reasons are that many of the houses have not yet been equipped with fires suitable for burning other than the more reactive semi-cokes, that the money required to finance alterations is not available, and that the Ministry of Health is not satisfied that sufficient supplies of the required class of fuel can be guaranteed locally.



Consent has been given by the Ministry of Fuel and Power to an extension of the Brimsdown Generating Station, which was opposed at a recent public inquiry by the Enfield Borough Council and other bodies.



Burnley Smoke Abatement Committee, formed in December with representatives from the Health Department, industrial bodies and local associations, has arranged a series of lectures for boilerhouse staffs. Opening the first of these lectures, which was well attended, the Medical Officer of Health, Dr. D. C. Lamont, said that the blood of women in Burnley, when examined, had revealed a content of only 75 per cent. red corpuscles instead of the 100 per cent. found in the women of Denmark—an agricultural country without a smoke problem.



Dr. J. R. Ashworth, of Rochdale, who is mentioned in the "Coming of Age" article on another page, is the author of a new book, "Ultra-Violet and Daylight Rays in the Solar Cycle," which is published by the University Press of Liverpool at 6s. net.

“FOG”

A Broadcast Talk to Europe by Dr. J. Bronowski

Few of our readers, we expect, were fortunate enough to hear this delightful talk by Dr. Bronowski, which was broadcast as a “As I See It” feature, in the European Service of the B.B.C. on 23rd November, 1949. We are glad to be able to print it in full, especially in this “Coming of Age” number, into which it seems to fit most aptly.—Ed.

GOOD EVENING. The English Poet Thomas Hood wrote a Poem in the last century which he called “No”—just that. Here are some lines from it :

*No sun—no moon !
No morn—no noon—
No proper time of day—
No road—no street—
No travelling at all—*

And then just as you are beginning to wonder what all this is leading up to Hood tells you the answer :

*No recognition of familiar people—
No comfortable feel in any member—
No warmth, no cheerfulness,
November !*

There it is, the English November, as we all read about it and grew up with it from the first adventure stories which we read as children. Dickens in *A Tale of Two Cities* ; Sherlock Holmes and the pea-souper fogs in Baker Street ; Jules Verne, whose English hero was even called Fogg. That wonderful old liar Baron von Muenchhausen who found fog so thick in England that he cut himself a cube of it and took it home. So those of you who are listening to me in Europe on an autumn evening may very well be thinking of London as lying under a cover of fog. It was the picture of London that I had when I was a boy years ago in Germany. And when I came to England 25 years ago, still a boy, I remember being struck by the forest of little chimney-pots which I saw all round me as the train brought me into London. I suppose that there

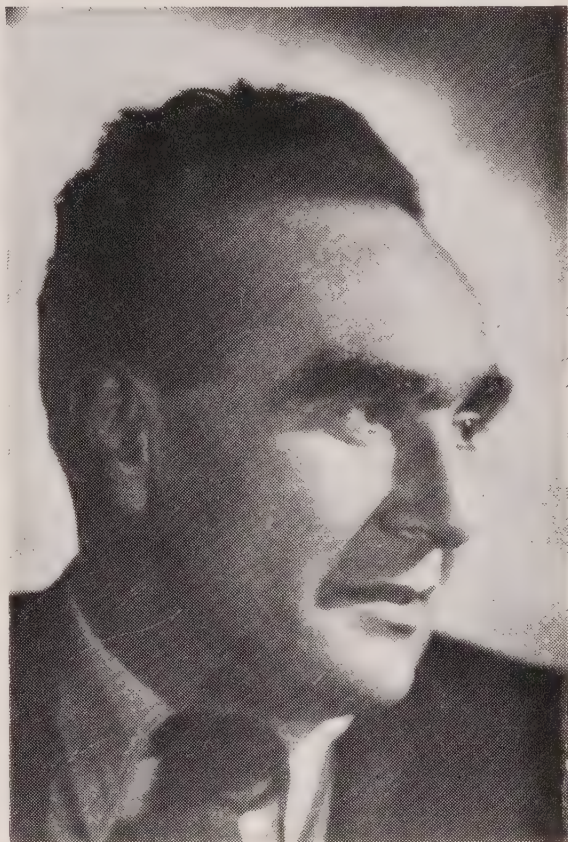


Photo : John Vickers

are about 10 million of those chimney-pots in the whole city. They are very much the product of Victorian individualism ; and they themselves are very much the producers of fog. But those millions of threads of smoke rising into the London air are thinner now than they were when I was a boy, as indeed they were thinner than they had been in the days of Dickens and Hood and Jules Verne. This November has been the worst we have had for years, and yet we haven't had a pea-souper of the type peculiar to Victorian literature about London.

Of course the great Victorian fogs weren't really romantic. They were gigantic, monumental nuisances. And I don't mean only the kind of nuisance Hood was writing about. They were bad for people's health, they were bad

for buildings. Seventy years ago, when statistics of this kind first began to be collected, the death rate in London from all causes almost doubled during a month of fog. Even ten years ago, the death rate from lung diseases—this is the death rate which fog sends up—nearly doubled after a week of fog. As for buildings, let's take the case of the Houses of Parliament. They were built a hundred years ago. Within ten years it was noticed that the stone and iron work were suffering from soot, dust and the corrosion of acids in the air. Since that time every year some of the stone and some of the metal has had to be replaced to keep the Houses of Parliament from falling on the heads of the Members.

Every great nuisance begins with waste and fog begins with the waste of coal. To make an English fog you need smoke and damp. The climate supplies the damp and London supplies the smoke. The smoke is just the unburnt part of coal. Benjamin Franklin pointed this out two hundred years ago. He said you must burn the smoke ; and he invented a stove to do it which is still used in America. The English diarist John Evelyn—the man who persuaded Charles II to take an interest in science—he knew this. Three hundred years ago he wrote a pamphlet called *Fumifugium*—disperse the smoke. Evelyn has since become—one might almost say—the patron saint of Britain's National Smoke Abatement Society. Ever since his day the attack on fog has been based on the need to prevent waste as much as on any moral indignation or on the need for clean lungs and clean linen. This of course is a very English touch : England is a country where everyone is always anxious to make it clear that their good deeds are also useful and economical.

England to-day mines about two hundred million tons of coal every year. Of that about a quarter—50 million tons—is still burned on open fires. Electricity and gas plants between them take about as much again. The rest goes to factories. But the share of the open fire is falling and the share of the

electric power stations is rising. And they are the cleanest burners of coal. Out of the ten million tons of smoke and soot and acid which go up into the air each year, they send up less than half a million.

How has this change been brought about ? When was it planned ? These are the obvious questions ; but, as I see it, there are no obvious answers. Here is a clear-cut case of waste ; and you might expect first a strong agitation on scientific grounds followed by strong action by the central government. But this is not how it has happened ; and to expect it to happen so simply is to misunderstand the sort of planning to which Britain inclines. There was indeed a government committee back in the 1920's which pressed for action—which was never taken. It was the same story 300 years ago when Evelyn asked Charles II to take the same action. Like most things in England, the change has been gradual—neither altogether planned nor altogether without plan. Events rather than edicts and regulations have set the pace. The nation as a whole has been reasonably well aware of the need for smoke abatement—because it improves health and saves coal and money. When events have tended in the right direction people have gone along with them. At other times very little has been done. Now coal has become more and more precious as time has gone on. So from year to year local councils, industrial firms—yes and private people—have done the best they could to improve the efficiency of their existing boilers and have decided to put in something better next time. It's typical too of Britain that it has been the enthusiasm of private citizens in the work of the National Smoke Abatement Society which has kept the need for economy and efficiency as well as cleanliness before the British people. It's only in very recent times that the Government has entered the field with its own type of planning. A government fuel research station has been opened, fuel economy campaigns have been organized and, generally speaking, they have been far-sighted and intelligently

run. But there has been a minimum of law making and a maximum of practical help.

There was a good example of this sort of thing during the Berlin Air Lift. Then, of course, it was vitally necessary to save coal, so the Allied authorities overhauled the Western sector electric power stations. That saved 150 tons of coal a day—it saved 15 flights a day into and out of Berlin. In England, too, necessity has tended to drive us into the arms of science. Getting rid of the open kitchen-range and cooking by gas and electricity instead has done more than anything else to clear the air. In 1945 when we made a special drive for fuel efficiency in Britain's factories we reduced soot over the whole country by 10 per cent. in a single year.

Of course when people speak of planning to-day—and many of you no doubt think of Britain as the home of planning—they usually mean official planning by governments. But even official planning in Britain tends to be reticent. How many people know, even in this country, that Britain is planning to change over most of her power stations to powdered coal in the

next ten years; and yet is not calling this important step forward a ten year plan for power or economy or anything. It's the essence of British planning—smoke abatement is a good example—that the best results come from the sort of planning which helps people to go the right way, and doesn't order them where to go or hector them in vast publicity campaigns.

As I see it, the story of fog, from the Baker Street of Sherlock Holmes to the present day, is one facet of the change from the individualism of the last century to the more closely integrated society of to-day. Those ten million chimney-pots which symbolise the Victorian age and the work done by housewives and housemaids in feeding the fires—these have given way increasingly to electric power stations. And the work of the housewife and the housemaid is done by a handful of electrical engineers. That is planning in the broader sense of the word. This is a change brought about by events and by the people themselves. The Government has been a referee and a director. In the largely spontaneous efforts to cure the evil of waste the evil by-product of fog is being gradually cured as well. Goodnight.

Correspondence

The Underloaded Boiler

*The Editor,
Smokeless Air.
Sir,*

If your publication is to achieve anything, its contents must be designed to appeal to that particular section of the public aimed at, in particular the technical section must be well served because it is here that the greatest interest can be fostered and the greatest contribution made to advance the ideals of SMOKELESS AIR.

The publication of your contributor "F.T.S.," "The Story of an Underloaded Boiler," works in the opposite direction; it is a pseudo-technical story which attempts to show what a clever

chap F.T.S. is, and, by implication, how dull and inefficient were the staff at the works, firemen, engineer, boiler manufacturers and directors.

Your contributor makes out a good case for installing a new boiler without any instruments—why spend money on installing them indeed, when F.T.S. and his like are being sent around by benevolent public authorities to put things right?

Such a story, Sir, would be better left untold in this fashion. Let F.T.S. leave the blow-off cocks and bricks to the technicians and go about his own business, which is not, I suggest, that of a Smoke Inspector.

Yours, etc.,

J. W. BATEY, M.I.MAR.E.

Sheffield.

THE DONORA EPISODE

The Donora Smog of October, 1948, has been the subject of an intensive investigation by the Public Health Service of the U.S. Federal Security Agency, on which a preliminary report,* of 173 quarto pages, has now been published and becomes one of the most important documents in the smoke abatement literature. The Report is reviewed by Dr. J. S. G. Burnett, Medical Officer of Health, Preston C.B., and Dr. A. R. Meetham, of the National Physical Laboratory and until recently Superintendent of Observations for the Investigation of Atmospheric Pollution.

I. *The Biological Studies*

By J. S. G. Burnett, M.D., D.P.H.

THE story of Donora, told in one short page, contains, to the imaginative mind, all the elements of a Hollywood drama—the enveloping fog, the motionless streamers of carbon hanging in the air like accusing fingers from the heavens, the sudden onset of respiratory illness in epidemic proportions, the telephone calls for medical aid, the grim uneasiness changing to restless foreboding till like wildfire the news swept through the town. Seventeen persons had died in less than twenty-four hours. Then nature relented, the heavens poured forth the cleansing rain and the foul product of man's folly was washed away whilst the town council met, town's meetings were held and succour was sought from the rest of the nation.

The writers of *Air Pollution in Donora, Pa.* do not however seek to emulate the feats of the screen and their preliminary report is a sober record, some 170 pages in length, of a careful and extensive scientific investigation (a) to ascertain the cause of the Donora episode and (b) to obtain information applicable to preventing future occurrences.

The medical facts relating to the episode are that under fog conditions, heavy local atmospheric pollution having occurred coincidentally, 42.7 per cent. of a population just under 14,000 experienced ill effects during a period of less than a week. As the pollutants in the air increased so did the numbers affected increase so that whereas between *S day —2 and 6 a.m. on S day +2 just over 800 people were affected, during the next 42 hours over 5,000 people were affected, and during S day +3 the deaths of 17 people took place. The rains came on S day +4.

Here is a straight case of toxic irritation arising from a heavy concentration in the atmosphere of a substance not sufficiently irritant to produce demonstrably large scale effects in the amounts normally present under ordinary atmospheric conditions.

Increase with Age

That the population generally was affected is evidenced by the figures quoted above but the incidence rates clearly show a marked increase with age so that almost two-thirds of those over 60 years were involved with a corresponding age relationship to severity of affection and in consequence heavy toll was taken amongst those with previously existing cardio vascular and respiratory disease. The symptomatology generally was that of respiratory irritation with smarting of

* *Air Pollution in Donora, Pa.* Epidemiology of the Unusual Smog Episode of Oct., 1948; Preliminary Report. Public Health Bulletin No. 306. Federal Security Agency, Public Health Service, Washington, D.C., U.S.A., 1949. (Available from the Government Printing Office, Washington, 25. price, \$1.25.)

* S day = the first day of severe smog.



An artist's impression of Donora. From the Report

the eyes, lacrimation, cough, sore throat, tightness of the chest, difficulty of breathing, headache, nausea and vomiting.

It is unfortunate that the statistical data take 0-6 years as the first age group and no special reference is made to the reaction in children under one year. This report is exhaustive in character and so the point will not have been overlooked but in this country where infant mortality and morbidity are always in mind even a comment that no unusual feature amongst infants presented itself would have been welcomed and, by its unusualness, would have justified itself.

Curiously enough although 10.5 per cent. of the population were classified as having suffered from a disabling affection only 50 cases were admitted to hospital. A possible explanation may lie in a different assessment of the need for hospitalization from that which prevails in this country but the main explanation probably lies in the rapid

subsidence of symptoms with the clearing of air pollution, for the disabling affection continued for more than one week in only 1.7 per cent. of the population. The implication would seem to be that gross secondary respiratory infection generally did not supervene on the primarily toxin irritated tissues, a point which is emphasized by the records of 32 hospital cases which revealed that in the main the presence of previous cardio respiratory disease was a significant factor in the occurrence of severe illness.

As would have been anticipated from past experience the inadequate scientific armamentarium available so far did not reveal any significant effects of local air pollution on health as a result of continuous living in the community nor did an interesting mortality and morbidity investigation except in relation to the catastrophe under review and, in respect of which mortality figures only were available, for a period

in 1945 when nocturnal smoke retention was apparently present in high degree.

The overall picture presented by this exhaustive survey is a not unexpected one of acute toxic irritation affecting the upper and/or lower respiratory tract. The irritant was apparently of such low irritant capacity as to fail to produce in ordinary concentrations abnormal reaction in the population as evidenced by normal chemico physical and statistical studies but under certain atmospheric conditions reached such a concentration that large numbers of the population became affected, the older members being more commonly and more intensely involved, and death occurring in certain persons showing previous cardio vascular disease.

This presents a close parallel with the description of conditions occurring in Glasgow and Leeds during the periods of heavy air contamination of a high incidence of respiratory disease, especially in the older sections of the population, with fatality in those whose weakened systems could not withstand the additional strain.

Inert Carbon Particles

There is the interesting possibility suggested that the inert carbon particles may act as the vehicle for an adsorbed substance non-lethal in ordinary concentrations by which is thereby enabled to act in a more concentrated form on the deeper lung substance. Herein lies a warning to the producer of black smoke and the creator of sulphur-dioxide the one with his plea of the harmlessness of carbon and the other with his excuse of dissipation by turbulence. Given the two ingredients in association with the right atmospheric conditions what havoc can be wrought among the old and the sick and what

unassessable damage may be afflicted on the respiratory mechanism of the healthy.

This report, whose authors deserve the thanks of all who have at heart the ideal of a clean air, is a valuable addition to the literature on aerial epidemiology. It is further evidence that the air we breathe can be so polluted that not only the asthmatics, the bronchitics and the tuberculous have to pay the penalty but the ordinarily healthy can be abruptly and completely incapacitated. It underlines heavily the experiences of Jervis of Leeds and of A. K. Chalmers of Glasgow as quoted by Sir Alexander Macgregor in his address to the Society at the Edinburgh Conference in 1947.

In the epidemiology of water the Croydon typhoid outbreak shook the country to the core, the Bournemouth enteric outbreak attributable to an infected milk supply roused the people to a high degree whilst the Aberystwyth ice cream epidemic was news value and so for weeks constituted a breakfast topic of conversation in practically every home in the country reached by the national daily press. But atmospheric pollution is, in the minds of many, a visitation from above and when the aged and the afflicted in our great cities turn their heads to the wall and succumb to the foul irritants of the atmosphere it is the will of God and nothing is to be done. And so it will remain until the people take heed of such words as those by one whose heart and soul found solace in the clear air of this earth's topmost peaks—

“Who are we with our factories, our ‘Black Country,’ our coal mines, our grimy smoke canopied cities and our slums, to air our innocence and preach our virtuousness.”

II. The Atmospheric Studies

By A. R. Meetham, M.A., D.Sc.

Sections III and IV of *Air Pollution in Donora, Pa.*, show that the technicians of the U.S. Public Health Service (Division of Industrial Hygiene), and

of the U.S. Weather Bureau, have creditably performed a very difficult task. They had first to discover the cause of the episode in October 1948, when

20 people lost their lives as a result of general atmospheric pollution. Secondly, they had to make recommendations to eliminate all possibility of a second occurrence. Thirdly, it may be assumed that they hoped to ascertain what general conditions might conceivably lead to similar disasters in other industrial areas. If this team of 25 persons from the Division of Industrial Hygiene, who worked intensively for five months at the scene of the disaster, and the eleven others (including two meteorologists) who helped, were asked if they were completely satisfied with the results of their efforts what would they say? Probably "No! Our recommendations would almost certainly prevent any recurrence of the disaster, but we are still not absolutely sure of the cause and consequently cannot be said to have completely achieved either the first or third of our objects."

There were no relevant scientific observations in Donora during the episode, except the daily maximum, minimum and noon temperatures at the U.S. Weather Bureau Co-operative Observer Station some 150 ft. above street level in the centre of the area. From February 16th to April 27th, 1949, however, an intensive survey of atmospheric pollution at twelve stations and of micrometeorology at nine stations was made. Twenty-two types of atmospheric pollution were investigated. After the biological team had failed to find specific effects, all but two were ruled out as possible causes of the episode—including fluoride, chloride, oxides of nitrogen, hydrogen sulphide and cadmium oxide. The blame was laid on sulphur dioxide and its oxidation products, together with particulate matter in general.

The report admits that the concentrations of these pollutants at the time of the episode could not be estimated, but it goes so far as to give the opinion that sulphur dioxide and its oxidation products could not, *by themselves*, have produced the clinical effects observed. The important point was made that "A gas such as sulphur

dioxide, which would normally exert its primary action in the upper part of the respiratory tract, might produce more serious effects if it were transported to the deeper parts of the lungs, as for example, by particulate matter."

In reaching this conclusion, many lines of approach were tried, though no attempt appears to have been made to follow up a remarkable statement by eye witnesses, that streamers of carbon appeared to hang motionless in the air. It should be possible by experiment to find the minimum concentration of smoke in which this phenomenon will occur.

Chimney effluents and their concentration in the air

Donora's industrial life is dominated by a steel and wire plant, and a zinc plant. The latter was estimated to emit 23 tons per day of sulphur dioxide and 30 tons per day of particulate matter during a test period when the plant was running at the same level of production as in October 1948. The data given in the report are sufficient to show that the steel and wire plant must have emitted about one-tenth of these quantities, but the report does not satisfactorily account for the sulphur in the 40 carloads of coke used daily in the blast furnaces. It estimated that about 5.6 tons per day of sulphur dioxide, and a similar amount of particulate matter, were discharged from domestic sources. Less than 2 tons per day of each form of pollution came from transport, including steamboats and trains.

The emissions of sulphur dioxide in Donora may be taken as about equal to that from a single giant power station, burning 1,100 tons per day of coal containing 1.5 per cent. sulphur, without flue-gas washing. The emissions of particulate matter are less easy to visualize; they seem much greater than would be expected from the general run of industry in Britain.

During the test period of ten weeks the average concentration of sulphur dioxide in Donora was similar to that in winter months at Sheffield *Surrey*



Photographs of Donora taken from the same point at same time of day showing comparison of atmospheric pollution on different days. From the Report

Street and London *Beckton* (see *The Investigation of Atmospheric Pollution*, five years ended 31st March, 1944, 26th Report; London, H.M. Stationery Office, 1949, Table 7). The general concentration of total particulate matter in Donora was in no period of five or more days more than about double the average winter concentration of smoke at Greenwich Observatory (*ibid*, Table 9). It is only in topography and micro-climate, apparently, that Donora differs from quite a number of smoky places in Britain.

Meteorological investigation

Donora is in a valley about one mile wide, the neighbouring hills rising about 350 ft. above the river level. The configuration of land was found to affect the direction of wind in most weather conditions, but on what are known as "radiation nights" the air movement in the valley became practically independent of the wind above. It is well known that on clear nights the ground radiates considerable quantities of heat to the sky and, in so doing, cools the air within a few feet of the ground. Cold air at the side of a valley drains downhill and it was found, at Donora on radiation nights, that the air in the bottom of the valley was on average 6 deg. F. colder than at the level of the hills above.

The atmosphere is very stable in such conditions. Instead of being changed frequently by wind and turbulence, the valley air became nearly stagnant. In the valley bottom it was found to be flowing up-valley, while 200 ft. vertically above it flowed the opposite way.

The meteorologists found the Donora "smog" episode to be an extreme case of this class of weather, in which the air was highly stable. The presence of water fog, as well as smoke, meant that the sun's rays were reflected back each day instead of reaching the ground, warming it, and breaking down the stability of the atmosphere. In these circumstances the only ways, for four days, that pollution could escape were by deposition on the ground and by diffusion along 30 or 40 miles of valley in either direction.

From the weather records of the past 30 years two other occasions were found to have occurred, in 1923 and 1938, when meteorological conditions were similar to those of October 1948; yet the death rate at Donora on those occasions was not different from normal. No satisfactory explanation is given, in the report, of why Donora escaped disaster on two occasions only to be overtaken on the third.

The report names the following requirements for severe smog conditions: (1) near and active sources of pollution, (2) topography such as that of the Donora valley, (3) sufficient moisture for fog to form and persist, (4) cloudless anticyclonic weather, with light winds, and (5) October the dangerous month (though the medical investigators found that a high death rate in April 1945 might have been partly due to atmospheric conditions).

Ten recommendations in the different sections of the report are summarized at the end. Eight of them refer to ways of reducing the pollution emitted from the various industrial processes in the two main industries. The ninth asks for a reduction of smoke from domestic heating systems, steam locomotives and steamboats. The tenth advises the use of special weather forecasts to warn the community in good time of impending adverse weather conditions. There is no recommendation that systematic measurements of pollution be made.

It is to be hoped that means will be found of carrying out all these recommendations in Donora, and as many of them as are applicable in other parts of the world. In Britain we have reason to be thankful that, in spite of the polluted atmosphere of our industrial areas, we have not been visited by disasters such as those of Donora, 1948, and the Meuse Valley, 1930. This may be because none of our heavy industrial regions are in deep, long valleys. Vigilance, however, is clearly necessary. From a study of the average concentration of sulphur dioxide and other contaminants, together with a know-

(concluded, page 89)

Some Thoughts on Railway Motive Power

BY

Sir Eustace Missenden, O.B.E., M.Inst.T.

*Extracts from a Paper read on 21st November, 1949, to the
Institute of Transport*

The Steam Locomotive

THE steam locomotive has served the world faithfully, but it must be conceded that, with the march of progress, it has been dethroned from its pedestal of public esteem—except in the eyes of enthusiasts. Smoke, steam, dirt and smells—once the symbols of power—are now hurled at us as evidence of a failure to modernize and of the approaching end of the railway era. Nevertheless, given suitable quality coal, adequate maintenance and cleaning, and skilled firing, the steam locomotive—and running sheds—while, of course, not comparable with electric or diesel traction need not be as dirty as they are. To-day's conditions are largely the price of war and economic impoverishment. They are, unfortunately, creating a serious prejudice against railways in general and the steam locomotive in particular, and there are few signs of any early improvement.

Even under the most favourable conditions, some smoke and smell must be emitted by a steam locomotive, which inevitably mar the pleasure of travel. The risk of lineside fires, with their economic waste and loss of goodwill among the rural communities, cannot be entirely eliminated with steam traction, despite modern improvements. The smoke nuisance, especially where tunnels are frequent or long, adds materially to the problem, and cost, of carriage cleaning, painting and maintenance, while the dirty condition of stock leads to complaints, claims for spoiled clothes, and again loss of goodwill. The corrosive action of the

smoke on stations, bridges, tunnels (including, of course, the rails as well) and other structures, spoils their appearance and reduces their life.

The Gas Turbine

The gas turbine appears to offer potentialities, especially in comparison with diesel-electric traction. These include greater simplicity, through the replacement of the complicated reciprocating diesel engine by the turbine, lower capital cost and a reduced length and weight for equivalent horse-power. The electric transmission gives it many of the characteristics and operating advantages of the diesel-electric—and even the electric locomotive—while it uses a cheaper grade oil and should be simpler and less costly to operate, service and maintain than a diesel-electric locomotive. It is, however, still in an early stage of development, which may require some considerable time.

Diesel and Electric Traction

We are, therefore, in practice, left to a choice of diesel or electric traction. The electric and the diesel-electric locomotive have much in common, apart from the fundamental question of the source of the electric power, namely, whether it is generated at central power stations and fed to the locomotive by an overhead wire or conductor rail, or whether it is produced on the locomotive by a diesel engine.

Both are modern and highly efficient forms of motive power, with characteristics and operating possibilities better

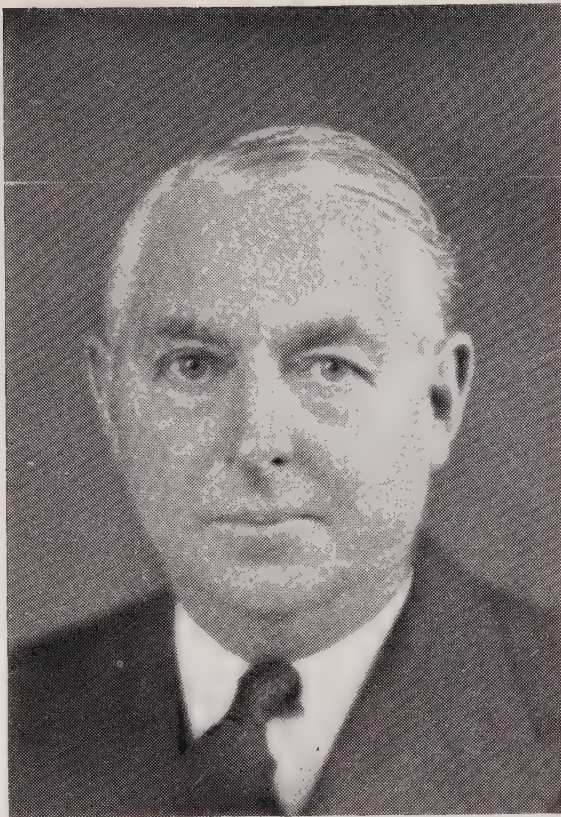
able to provide the type of service and speeds required in the future than steam traction. Both would remove the smoke nuisance, with all that it involves, although the diesel exhaust is a drawback. Both could lead to a great improvement in the appearance of stations and trains, to an increase in the attractiveness and pleasures of travel and would be signs of a determination to keep pace with progress.

The Diesel Locomotive

The diesel locomotive, which, like the steam locomotive, is a self-contained power unit, makes use of the high thermal efficiency of the internal combustion engine. It is essential, however, to interpose a transmission system between the diesel engine and the locomotive driving wheels, and this, in principle, can be mechanical, hydraulic or electric, although satisfactory forms of the first two have not yet been evolved for outputs in excess of 300-400 h.p. But, the "Fell" 4-8-4 1,600h.p. diesel mechanical experimental locomotive now under construction holds out possibilities for the development of a satisfactory form of mechanical transmission for the higher power ranges. If success is achieved, it will greatly simplify, and reduce the capital cost of, the diesel locomotive.

At present, however, the only effective system of transmission is for the diesel engine to drive an electric generator, the current from which is used to drive the traction motors, as on an electric locomotive or motor coach. As the diesel-electric locomotive comprises three separate elements, namely, diesel engine, electric generator and traction motors, as well as considerable auxiliary gear, it is, especially in a main-line version, complicated, heavy and very expensive in first cost.

The character of traffic and operating conditions in this country, with our comparatively few long runs, will make it difficult, if not impossible, to provide economic rosters for main-line diesels, except on selected workings, though the recasting of timetables, where practicable, and the accelerations and increases in services, may help in this



Sir Eustace Missenden
Chairman, the Railway Executive

direction. In the United States with their long runs, 1,000-mile daily rosters, seven days a week, are not uncommon with diesels. Even on the exceptional Euston-Glasgow run, with a round trip every 24 hours, the maximum rostered weekly mileage of the twin-diesel is only some 5,600.

The future of the diesel in this country, at the moment, in my view, lies (i) as a shunter at large yards where work is more or less continuous throughout the 24 hours; (ii) in the form of a medium powered unit for use on branch lines in electrified areas and (iii) possibly, railcars. The 350 h.p. diesel-electric shunter, in spite of its high capital cost, has proved itself more efficient and economic—especially with one-man operation—than the steam locomotive, so long as the character of the traffic and operating conditions are such that full advantage can be taken of the availability of the diesel. It is particularly advantageous where a number of diesels can be based on one specialized fuelling and maintenance depot, so that full use can be made of these facilities. Under



Britain's first gas turbine locomotive built in Switzerland by Brown Boveri, Baden, and the Swiss Locomotive Co., Winterthur, for British Railways, and now on test in this country.

these conditions, the diesel can do the work better and save at least 10 per cent. of its cost per annum. British Railways are, therefore, adding considerably to their fleet of diesel shunters.

Electrification

The electric locomotive, and also the multiple unit train, is not a self-contained unit; the prime mover is in central power stations where the energy in the coal—or oil and water power—is converted into electricity. In consequence, any system of railway electrification involves considerable capital expenditure on the provision of a power distribution system, including sub-stations and an overhead conductor or a third rail.

Electric traction has all the advantages of diesel traction already referred to, and usually to a greater degree, e.g. performance in climbing gradients; suitability for multiple-unit operation; economies in coasting; the complete absence of exhaust fumes, and of the need for replenishing with fuel or water, or other servicing en route. Apart from periodical examination and servicing, electric locomotives and multiple-unit trains are ready and available for continuous use at any time.

But electrification, in this country, can be justified only if the increase in traffic and revenue attracted by the improved services, and/or a reduction in

working expenses, are sufficient to meet the increased capital charges involved.

On suburban and inter-urban routes, experience almost everywhere—both in this country and abroad—has been that the faster, cleaner, more frequent and regular services introduced following electrification have resulted in substantial increases in traffic and revenue. The electric services have led to the dispersal of population from the cities and encouraged the travel habits of the population.

For main line, as opposed to suburban, electrification, the economic justification must depend primarily on a reduction in working expenses, since the possibilities of securing material increases in passenger traffic and revenue are necessarily more limited. It is my belief that, on balance, once our immediate economic difficulties are over, and capital investment is less restricted, conditions will be not less favourable for electrification—both main line and suburban—than before the war; in certain respects they will be much more so.

Overseas Experience

A glance at experience abroad indicates in a dramatic way how, and particularly since 1939, the steam locomotive has been dethroned from its former pre-eminence.

In North America, diesel-electric traction has in the last decade, made astounding progress. A revolution in motive power has taken place in the United States, and in 1948, for the first time in history, the number of passenger train car-miles operated by diesel traction exceeded that by coal-burning steam locomotives.

The railways of North America, with a few exceptions, have virtually ceased to order steam locomotives and are now buying diesel-electric locomotives exclusively; several of the smaller railways are completely dieselized; and one of the three principal locomotive builders is reported to have ceased producing steam locomotives. The Vice-President of the Canadian Pacific Railway announced last March that a steam locomotive then delivered might be "the last steam locomotive" ever purchased by them, since diesel-electric locomotives were now recognised to be the most efficient type of motive power, and they intended to follow this trend.

Turning to Continental Europe, we find that, apart from shunting locomotives and rail-cars, diesel-traction has made but little headway. Railway conditions in Europe are more akin to those in this country and the trend towards electrification is most significant. Thus, despite the differing railway and economic conditions in the individual Continental countries, a large number of railways have, since the war, announced extensive electrification programmes.

National Considerations

Policy and practice abroad, valuable as they are as a guide and spur, must, of course, be examined in the light of railway conditions and other relevant considerations in this country before any really useful conclusions can be drawn. It is desirable, therefore, to consider, briefly, the British background.

British economy has been built up predominantly on coal; we have but little water power and no oil. The railways are bound up with the coal industry. In spite of the high prices, shortage of suitable grades, the delivery

difficulties of to-day, and the absence of signs of any rapid improvement in the coal position, we should have to be very sure of our future before we were irretrievably committed to dependence to a considerable degree on oil. Coal is in the country; we hope that it may not always remain scarce and dear; it does not need foreign exchange. These are vital strategic and financial considerations which we cannot ignore. If we use coal in the form of electric power, we should use a lower and cheaper grade, use less of it and use it more efficiently. The Weir Committee estimated that the complete electrification of the British Railways would lead to a reduction in the annual coal consumption from 13.4 to 3.6 million tons. We should facilitate—though only to a limited extent—the development of the national electricity system, and eliminate the transport, storage and handling of locomotive coal and water, and also ash disposal.

The future may well see strong public pressure for smoke abatement, especially in urban areas, and the railways will be a main target of criticism, both the running sheds and steam locomotives. The steam locomotive, with its smoke, dirt and smell will become increasingly unpopular with passengers, who will tolerate still less the dirty station and carriage. We cannot abandon steam traction at considerable cost merely to satisfy the town planners or the health authorities, or to reduce an inconvenience to our passengers. Yet, other conditions being favourable, we should be prepared to go forward with electrification supplemented by diesel traction, in order to reduce the smoke nuisance and greatly to improve travelling conditions.

Donora—concluded

ledge of the variance, it ought to be possible to predict, very approximately, what the highest concentration in a period of, say, 10 years, is likely to be. Unfortunately there is no reliable information, from either of the disasters, as to what is the dangerous concentration of pollution.

Smoke Control in Los Angeles County

The Address to the Harrogate Conference by Henry Burns of the Los Angeles County Smoke Control District, California

The County is a territory of 46,000 square miles, which includes 45 incorporated cities of various sizes, the largest of which is the city of Los Angeles, which to-day has a population of not quite two million. The County is in the form of a peninsula, bounded on the south and the west by the Pacific Ocean, and on the north by a semi-circular range of mountains averaging 5,000 ft. in height. About 30 to 50 miles from the west coast there is a perpetual high pressure area. Over the entire land-board are "planes" of temperature inversion, varying in height from ground level to approximately 3,000 ft., and recorded observations have shown that the temperature at the base of the inversion have exceeded by over 14 deg. F. those on the ground. Thus, with the prevailing off-shore breezes and the back-drop of ground, sources of atmospheric pollution must necessarily spread laterally. Back in 1940, before the war, the area included approximately $1\frac{1}{2}$ million people, and there was little industry—somewhere in the neighbourhood of 2,000 industrial factories. To-day the area includes not quite four million people and over 10,000 industrial plants. Because of the tremendous increase in industry and the influx of population, the pollution has increased by leaps and bounds, and public opinion has forced the issue and demanded air pollution control.

In the early 1940's the city of Los Angeles saw fit to enact an Ordinance about air pollution, which in the main was related to smoke. Very shortly afterwards the County saw fit to enact a similar Ordinance. However, these two Laws paralleled each other, and the jurisdiction of each was restricted to their respective areas (as far as the city of Los Angeles was concerned, to

unincorporated areas of the County). The County, realizing the necessity for an overall control, then relegated me, in conjunction with the County Council, to approach the governments of the remaining 44 cities to ask them to enact an Air Pollution Control Ordinance similar to that of the County, and to enact additional legislation to empower the County to enforce it.

After travelling about with the County Council for eight months we succeeded in getting 25 of 44 remaining cities to enact legislation. As the result of being one of the newest States who were interested in this particular work, we decided to look into the problem of air pollution control. Industry fought it tooth and nail, but we succeeded in getting legislation through as a section of the State Health and Safety Code to give a basic Smoke Law, empowering any County within the State to invoke the sections of the Act within the limits of that County. These Counties could also in their legislation impose any rules or regulations, but they had to be more stringent.

The position became violent, but we succeeded; Los Angeles was the only County to push the legislation through. The organization within the district consists of approximately sixty people. All are engineers or engineers in training, smoke inspectors, etc. All these people are seriously engaged in this work. We have quite a number of dollars to play with! The annual budget is somewhere between £100,000 and £150,000. Motor cars are provided to travel to destinations; laboratory and research facilities are incidental, but the moneys involved are considerable. The method of smoke control in the County is that we follow the basic Smoke Law, but it probably will be a

great surprise to you that we work on the basis of the Ringelmann Chart. We state that a person shall not discharge into the atmosphere any air contamination for a period of more than 3 minutes in any one hour as dark or darker in shade as shown as No. 2 in the Ringelmann Chart. In addition, we have the following: a person shall not discharge from any source such quantities of air pollution as to cause injuries, detriment, annoyance or a nuisance to any considerable number of persons, or which endanger the comfort, repose, health or safety of such persons. In addition, a person shall not discharge into the atmosphere particular matter in excess of 0.4 gr. per cubic ft.

Specific contaminants: A person is forbidden to discharge sulphur compounds in excess of 0.2 per cent., or solid products of combustion calculated at 12 per cent. of CO₂.

We have also established a table in relation to the emission of dust and fumes, and have tried to take into consideration the problem of the small manufacturer as opposed to the large industrial concerns.

We have prepared a method of control whereby our Smoke Inspector is appointed as Deputy Sheriff, with the police power thereto attached. He has the right to issue a citation to the individual offending the public, or, failing the latter, ordering him immediately to cease. Failure to comply can result in fines varying from £100 for each and every offence. Jail sentences may also be given. We do not propose always to invoke this legal matter, but we also have the right to shut down any plant that does not comply with the Law until such time as it does. This brings very excellent results.

The problem of Prior Approval; you people are toying with it—we have it. Under our rules and regulations no person or Company can install any piece of equipment which is capable of producing air contamination unless it has first received prior approval from us. We can, if necessary, go to the extreme of shutting down the plant

and stopping work, or arresting the individual.

In the area of California in general we burn no coal of any kind. Fuels are natural gas, oil and hydro-electric power. We have a great number of major oil refineries. These refineries emit approximately 1,200 tons of sulphur gases per day. This causes us some trouble, but with the equipment we have made these people install they can now collect about 300 of this 1,200 tons. Additional plant will be installed which will collect 500 tons, and in two years the remainder will be collected.

However, we have felt that in the organization we have set up to-day in the method of application of the law, we have propounded and put into use a model Ordinance. We have praise from every part of the world, and we recommend our method as it has worked out.

In the eastern area of the country they have finally reached the conclusion that the homes as well as the industrial concerns must install some kind of mechanical stoker, where they burn soft coal. This is something more difficult to enforce.

I should like to add that there are two men appointed to patrol the highway to watch emission from road vehicles; another man goes to the railroads to watch for engine smoke, and another man watches ships in harbour for the same purpose. When an offending vehicle has been stopped on the highway and has been cited twice within a 30-day period, he comes before the Board.

A settlement has been reached between the parties in the Scottish litigation arising from the dispute between the proprietors of estates in the Lochaber district and the North British Aluminium Co., Ltd., over the emission of noxious fumes from the company's factory at Fort William. According to a statement issued by the solicitors for the parties "all outstanding differences between the parties have been disposed of amicably." The principal factor in the case has been the fluorine content of the fumes.

SMOKELESS HOMES



Smokeless Fuel

ALL local authorities in Great Britain have received copies of a resolution passed at the Harrogate conference of the Society, in which it was regretted that "in many instances bituminous coal is being burnt in grates suitable for smokeless fuel in local authority estates," the smoke from which was "in some cases exceptionally offensive from its being emitted at a low level from pre-fabricated bungalows," and asked all local authorities "to encourage the use of smokeless fuel in these grates."

A surprisingly large correspondence with the local authorities has developed from this communication, which reveals difficulties in the distribution and availability of solid smokeless fuels, a valid criticism of the fact that in many areas the price of gas coke, the most abundant smokeless fuel, is substantially higher than that of bituminous coal in the same area, and, rather disturbingly, a serious lack of information or understanding on what smokeless fuels are.

Representations about the price of coke are being made by the Society to both the Domestic and the Industrial Fuel Consumers' Councils, and the question of creating a better understanding among both the local authorities and the public of the facts about smokeless fuel usage in the home, are being considered by the Publicity Committee. The problem at the moment centres round gas coke, for the output of low temperature carbonization fuel is fully taken up, and supplies of anthracite and other Welsh smokeless coals are not likely to be increased for the home market to any marked degree in the near future. Gas coke, however, has

been entirely freed from rationing and there is, we understand, plenty in stock. Apart from the important question of price, there are also matters of sizing, quality, and dryness that we should like to see examined.

Good Publicity

We were pleased to notice recently, in the showrooms of a gas undertaking in the north-west, how the whole of a large window space was devoted to displays showing the value of coke as a domestic fuel, and how the new approved smokeless fuel fires were being publicized and offered on hire-purchase terms of no more than 4d. a week. This is the kind of campaign that is needed throughout the country. There are encouraging signs that the smokeless fuel fires and even the more efficient though hitherto less popular "open-close" stoves are beginning to "catch on" among the public—so now is the time to press forward.

Housing Manual, 1949

This agreeably produced and well illustrated volume (published by the Ministry of Health through H.M. Stationery Office at 3s. 6d.) takes the place of *Housing Manual*, 1944. It will be followed by a companion volume of *Technical Appendices*, which we expect will deal with fuels and heating questions in more detail than has been possible in the general publication. This does contain, however, a chapter on "The Heating Installation," in which is stressed the importance of installing in new dwellings the improved appliances now available. Among other things, "atmospheric pollution due to domestic fires can be greatly reduced by the

development and use of efficient appliances designed to burn smokeless fuels and/or household coal with a reduced production of smoke." Types of appliances and systems for solid fuel, central and district heating, gas, and electricity, are all considered in general principle.

Some New Information Booklets

Even if it was desirable for it to attempt to do so, the Society hasn't the resources to collate and publish all the information now available about smokeless methods in the home on which it is frequently asked, but it can always supply the information about the specialized publications of the various fuel industries and associations that among them can tell the inquirer all he wants to know.

Among the latest publications of this kind are *Solid Smokeless Fuels*, published by the Solid Smokeless Fuels

Federation at 1, Grosvenor Place, London, S.W.1, which most interestingly describes the different fuels and their uses and properties, and the appliances in which they can be used. *The Newer Heat in Modern Homes*, which gives a wealth of information about the different types of modern solid fuel appliances, and plans showing types of heating installation being used in actual practice by local authorities, is published by the Coal Utilisation Joint Council at 13, Grosvenor Gardens, S.W.1. And from the British Electrical Development Association, 2, Savoy Hill, London, W.C.2, comes *Electricity Turns Old Houses into New Flats*, in which ways and means are described for using electricity for all purposes in the many conversion schemes now in progress. Wiring and other technical information is included.

Each of these three publications is fully and attractively illustrated with informative photographs.



From our Photo Library—5

Aero Pictorial Ltd.

Thames-side from the Air

(Taken over East Tilbury, looking west. Note the Thames on the left).

Smoke Prevention Abstracts

129. Corrosion of Metals. I. General Principles; II. Preventive Measures. Vernon, W. H. J. (Two Cantor Lectures, Feb. 1949; J. Roy. Soc. Arts, 1 July, 1949, vol. 97, 578-610). I. After a brief assessment of the economics of the process, the distribution and nature, in particular the electrochemical characteristics of atmospheric, underground, immersed and anaerobic corrosion are described and promoting and controlling factors associated with the metal and with the environment are considered. The influence of humidity and atmospheric pollution on the formation and breakdown of surface films is discussed. II. The field of corrosion prevention is covered in the following scheme: 1. Modifications of design or procedure, (a) design of structures, (b) surface conditions, (d) cathodic protection; 2. modifications of environment (a) water treatment (pH control, de-aeration, etc.), (b) inhibitors for wrappings and temporary protectives, (d) prevention in enclosed air spaces; 3. modifications of metal, (a) influence of purity, (b) corrosion-resistant alloys; 4. protective coatings, (a) natural and artificial films or coatings of reaction products, (b) paint and other organic coatings, (c) metal coatings, (d) miscellaneous coatings.

130. Smoke, Cosby, W. T. (Brit. Coal Utilization Res. Ass. Month. Bull., July, 1949, vol. 13, 225-231.) A review of recent advances of knowledge relating to the formation and physical and chemical characteristics of smoke under the following headings: chemical composition of smoke; physical nature of smoke; methods of smoke measurement—appearance, optical destiny, gravimetric methods; general factors influencing smoke emission; formation of carbon in flames; combustion of distillation smokes.

131. Abatement of Smoke and Cinders on Locomotives and at Engine Houses, May H. E. (Rly Age,

6 Aug. 1949, vol. 127, (6), 40-41.) A paper describing the methods employed by the Illinois Central Railway to abate smoke during the firing-up of locomotives and stationary boilers; these include methods of banking coal in fireboxes; supplying compressed air to the firebox by means of an "air fork"; the use of over-fire devices operated by steam jets; and means of preventing the spreading of fly ash and soot from the locomotive chimneys while cleaning fires, by a scrubber device placed over the chimney. The use of steam over-fire jets in stationary boilers, the elimination of jet noise and the maintenance of over-fire jets are other matters dealt with. Particulars of the devices are given.

132. Management and Fuel Utilization, Mason, J. B. M., Powell Duffryn Technical Services, Ltd. (Fuel Econ. Review, 1949, Fedn. Brit. Industries.) After full discussion of the subject the author concludes that although much lip service has been paid to fuel efficiency during the past few years and some "window dressing" has occurred, the savings made, while substantial, are mainly due to the application of fuel economy measures. The field of fuel efficiency proper remains practically undeveloped and the savings which would accrue, were real steps taken to *apply* existing knowledge to industrial plant now under operation are very vast indeed.

133. Nuclear Energy as a Source of Power. (Fuel Econ. Review, 1949, Fedn. Brit. Industries, 63-68.) The general principles of the processes involved in the operation of a natural uranium reactor are discussed, and some of the factors involved in the use of the available thermal energy for power production are mentioned. Following an outline of alternative types of reactor is a review, taken from published literature, of the economic considerations involved in the industrial use of nuclear energy, and of some possible future developments.

News

The Public Health and Housing Committee of the Lancashire County Council state in a report that to explore every possibility of preventing atmospheric pollution in the County, they asked the County Planning Committee to consider the extent to which their powers under the Town and Country Planning Act, 1947, could be used to prevent smoke nuisances arising from industrial development and to consider taking action for the removal or prevention of spoilbanks. Quoting from the report: "It is the practice of that Committee, and they have given careful consideration to this question, to attach conditions to planning permissions for industrial development likely to result in considerable smoke. In normal cases these conditions require applicants to take all reasonable steps to prevent injury to the amenities of the neighbourhood by the emission of smoke, dust or fumes. In cases where special consideration is warranted, such as generating stations or special industrial undertakings, this aspect has been considered in detail with a view to ensuring that apparatus is used which will prevent injury from smoke, dust or fumes."



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More *Americana*—A smoke prevention clinic has been set up in New York, with a staff of engineers to give advice, by the Anthracite Institute. ★ A suit for nearly half a million dollars has been filed against the California Cement Company for alleged damage to an 8,700 tree orange grove. It is claimed that smoke, fumes, and cement and plaster dust have "stunted and weakened" the trees and made them valueless. ★ A National Smoke Abatement Week was held in the U.S.A. and Canada in October last. A two-day conference in New York was attended by about 1,000. ★ William H. Byrne, Director of the New York Bureau of Smoke Control, estimates that the city's smoke has been reduced from 10 to 15 per cent. through voluntary co-operation with the Bureau. ★ The *Vancouver Sun* urges an all out attack on the city's smoke similar to that in U.S. cities. ★ 2 million dollars have been spent during the last three years on smoke prevention in Ottawa. ★ The University of Michigan, school of public health, announces a short non-credit course in air pollution. Fee, \$5.00. ★ 400 scientists and others attended a National Air Pollution Symposium in Pasadena in November, 1949. We hope to publish a full report in an early issue.



A public inquiry was held in January into the proposal to erect a new generating station at Crimpsall Ings, near Doncaster. Objectors claimed that the station could be better sited away from the town, and injury to health and property would result if, as had been admitted at the inquiry, 1½ tons of ash and 2½ tons of sulphur dioxide a day were thrown into the air over Doncaster. For the B.E.A. it was said that to build the station at one of the alternative sites, Thorpe Marsh, would add at least £500,000 to the capital cost and £40,000 to the annual charges. Among witnesses for the Doncaster Civic Trust was Mr. T. Henry Turner, Chairman of the Society's Yorkshire Division.

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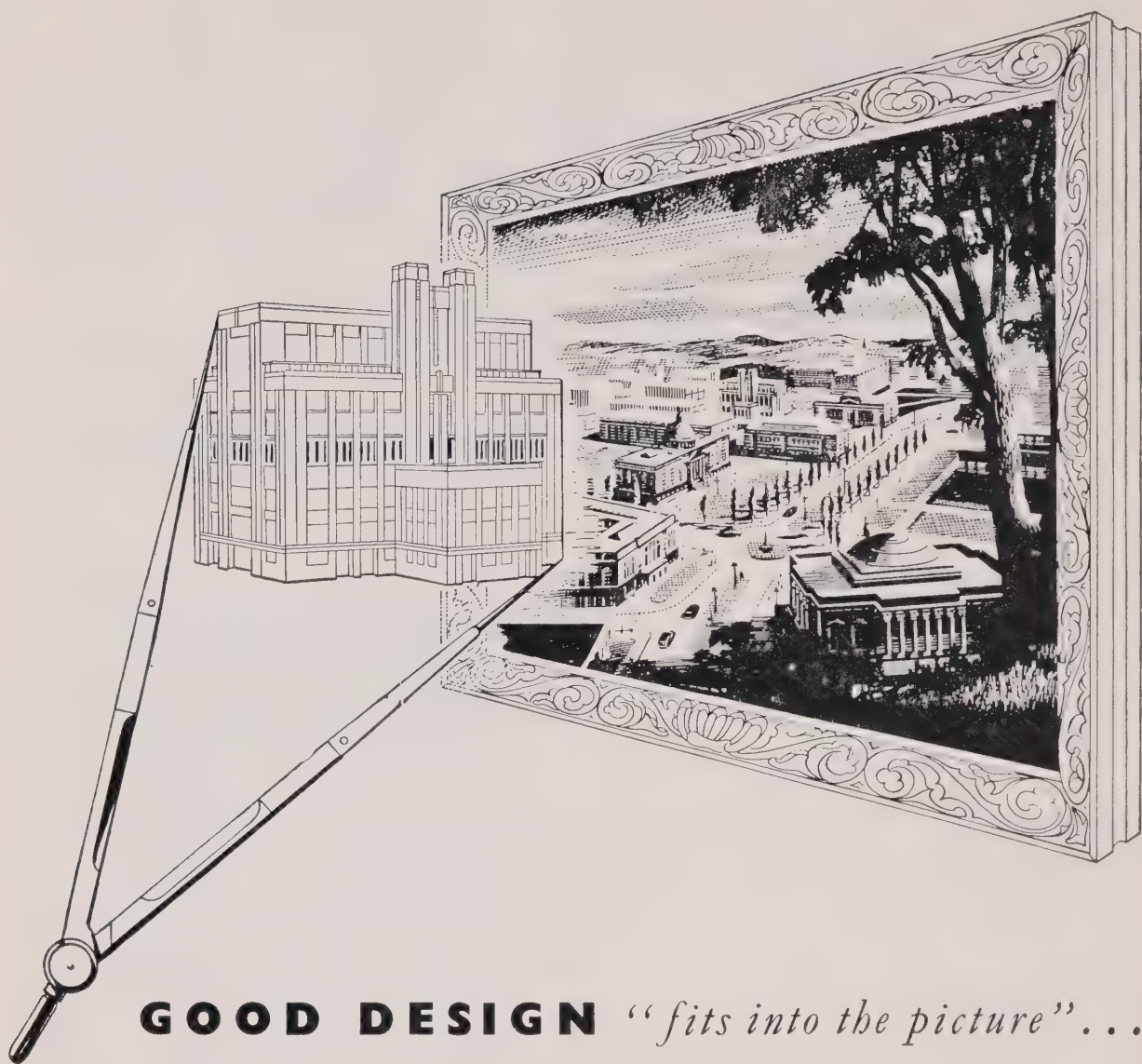
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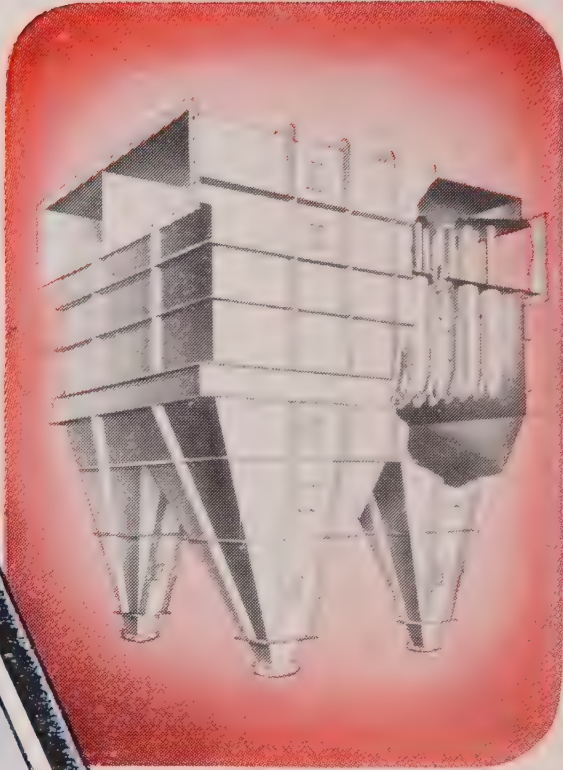
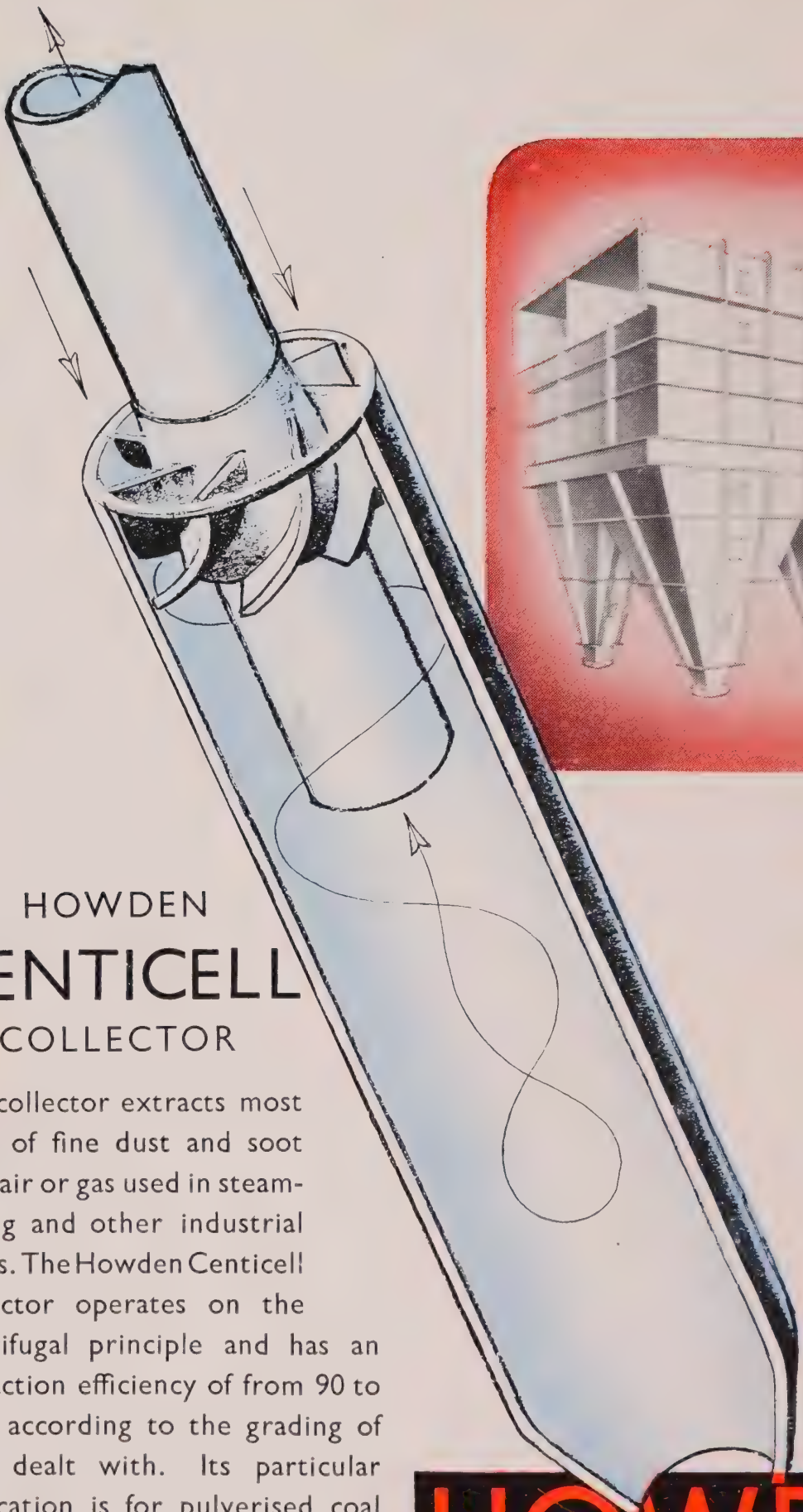
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 74

SUMMER

1950

ONE SHILLING

In this Issue

The Society Comes of Age

Will Melland

Watson House

District Heating

Abstract Record of Pasadena Symposium

The Divisions In Conference



GIVE UP SMOKING?

I NEVER STARTED! *says Mr. Therm*

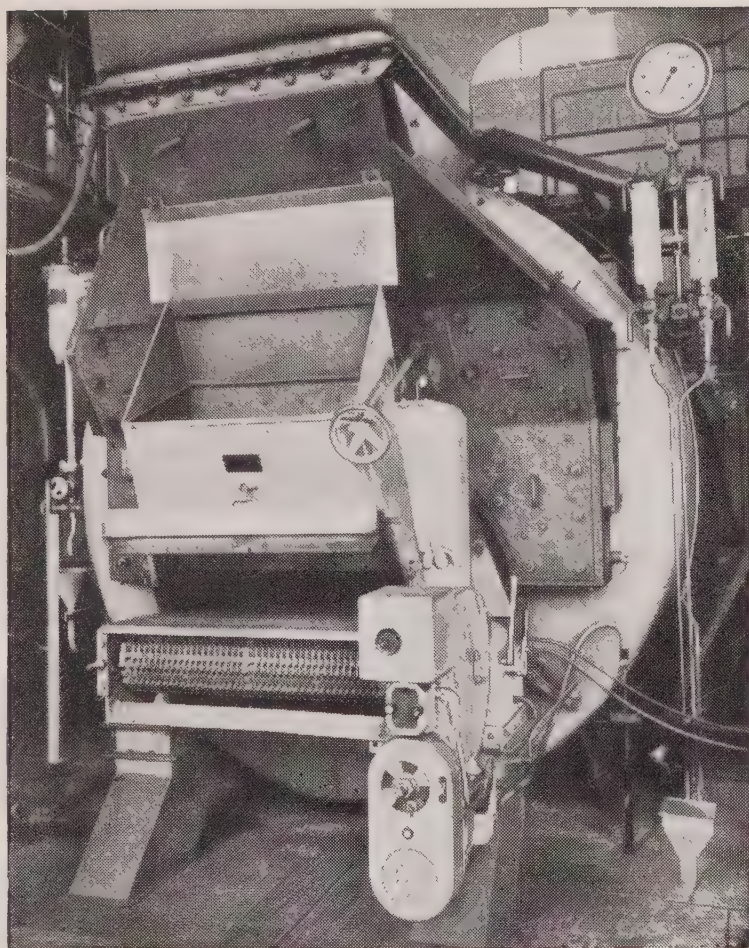
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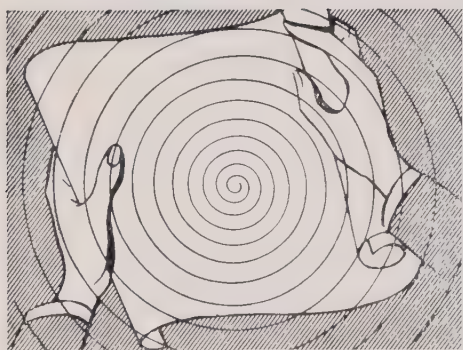
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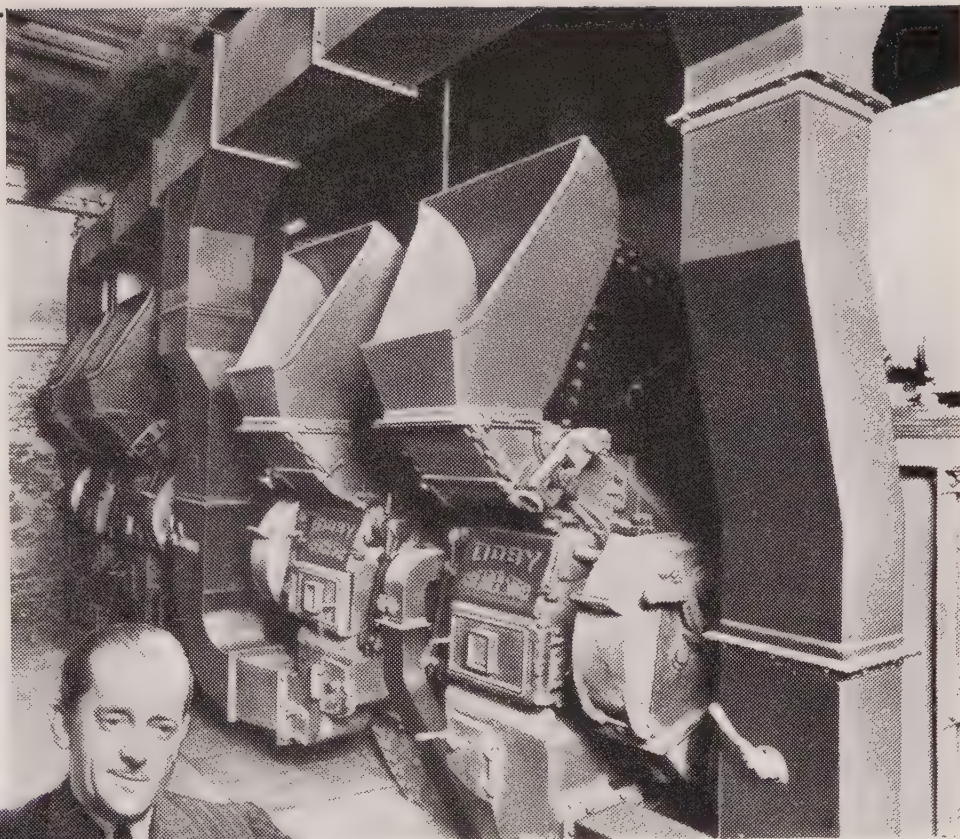
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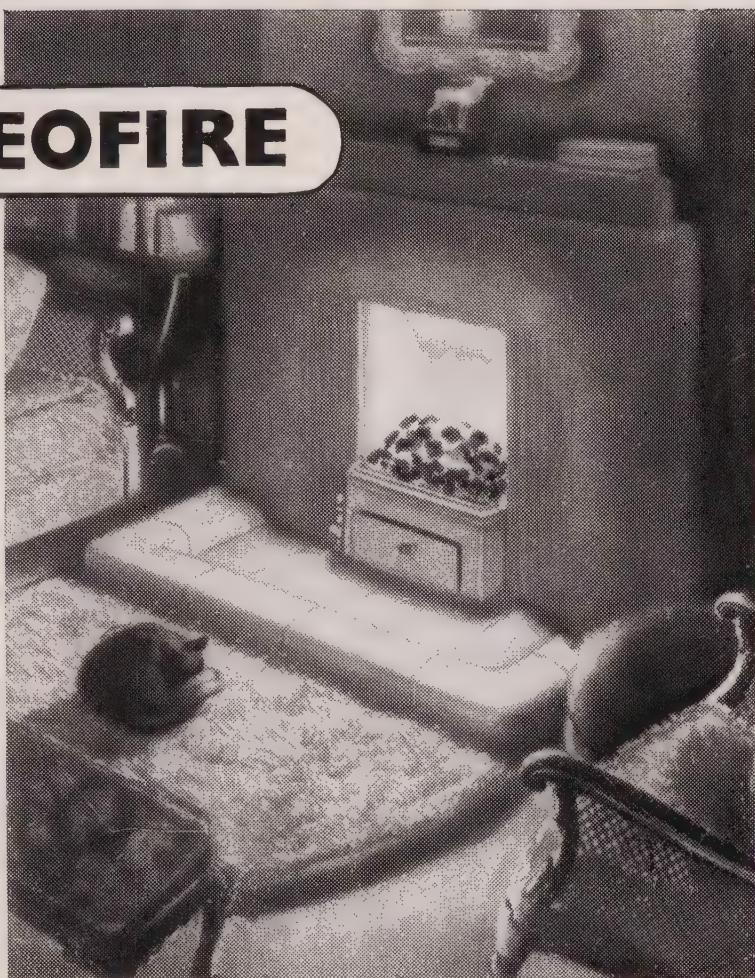
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SMOKELESS AIR

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Summer, 1950

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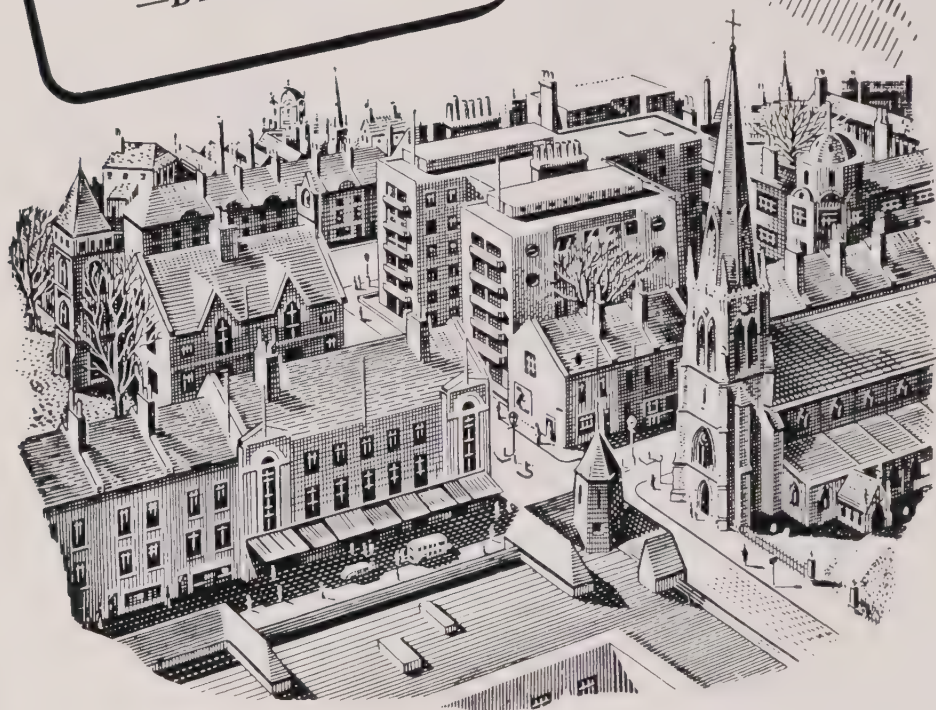
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

The Des Voeux Memorial Lectures

THE Margate conference will be marked by the inauguration of a series of special lectures to be known, in commemoration of our first President, as the Des Voeux Memorial Lectures. Their purpose will be to provide each year a platform for a distinguished speaker whose subject, though concerned with smoke abatement in a general way, will seek to relate it to subjects of wider import. They are intended, in a sense, to put our special subject in perspective against a background in which we find history, science, medicine, culture and

the arts, and social reform. This can best be illustrated by referring to the arrangements that have been made for the first of the lectures. The author will be Dr. D. T. A. Townend, Director-General of the British Coal Utilization Research Association and President of the Institute of Fuel, who will speak on what may be roughly summed up as the idea and the story of the better utilization of coal. This is of fundamental importance to the smoke prevention movement as well as being a fascinating example of the steady evolution of new conceptions and of scientific endeavour. We are fortunate in both the subject and the speaker for this first lecture.

The General Programme

If the Des Voeux lecture is to give us a broad, far-ranging survey, the other papers at Margate will focus attention on specific problems of immediate concern. There will be a symposium of five papers on the subject of smoke prevention as applied to new housing ; in another session the fundamentally important question of the ill-effects of smoke on human health will be discussed ; and finally there will be two papers on the difficult question of railway smoke.

In the housing session Mr. C. H. Walker, Director of Housing of the London County Council, will review the situation from the local authority viewpoint. Mr. C. A. C. Turner, Chief Executive of the Crawley Development Corporation, will speak on the problem as it affects the New Towns. Alderman G. H. Goulden of Salford will explain the plans being made in his city for smokeless zones that will include houses. Alderman Dr. Joseph Robinson will tell us of the pioneer action of Stretford in making the use of smokeless fuels a condition of tenancy in suitably equipped houses. Finally, Mr. F. J. Redstone, Chairman of the Society's Publicity Committee, will report on inquiry being made by the Committee on the smokeless fuels supply position.

Dr. J. S. G. Burnett, Medical Officer for Preston and a member of the Society's Executive Council and Technical Committee, will open the Health session that will in particular review our knowledge of the effects of polluted air on the respiratory system, and he will be followed by a paper on recent researches into the effects of air pollution in relation to cancer of the lung, to be given by Mr. R. E. Waller, of the Pathological Department, St. Bartholomew's Hospital, London.

On railway smoke Mr. W. O. Skeat will give a paper on ways and means for reducing smoke under existing conditions, and will refer to the position in other countries. Mr. Skeat is an independent authority on railways, and will be followed by a paper by



Dr. D. T. A. Townend,
Director-General of the British Coal Utilization Research Association, and President of the Institute of Fuel, who will give the first Des Voeux Memorial Lecture.

Mr. M. G. Bennett, of British Railways, who will show what is actually being done to reduce smoke at present, and how future developments can be expected to lead to still greater improvements.

We think members will agree that the programme for Margate will be unusually interesting, varied, and of practical value. All other details will be given in the complete programme to be issued shortly to those who have been registered as attending. Invitations and appropriate reply forms have already been sent to all members and their representatives, and any other readers who are interested may obtain copies on request. The conference will open on the afternoon of Wednesday, September 27th, and will close at the end of the afternoon session on Friday the 29th.

America Goes To It

On another page will be found a further special abstract record of a

recent conference held in the United States on air pollution. A similar record for an earlier 1949 conference was given in our last but one issue, and we now learn that there were another seven conferences during that year at which air pollution was the only, or the principal subject! And now, May, 1950, the Technical Conference urged by President Truman in his letter to the Secretary of the Interior, which was reprinted in our last issue, has been held. On this occasion no less than 90 papers were presented—we do not say read—and we hope to give some account of these at a later date. Official representatives from Government departments in this country attended, and although associations such as this Society were not invited, Dr. R. Lessing received a personal invitation, so that the Society was in fact informally represented.

In addition to these many papers, some of which are of importance to us in Britain, there is a continuous flow of articles and press cuttings from the U.S.A. (and Canada) coming into the Society's offices, and we seem to be witnessing an intense wave of concern and activity in air pollution problems different in degree and kind from anything noted before. The Donora incident, which came as a serious shock to both the public and administrators, is largely partly responsible for it, but there are also many other developments that were in train before Donora and are now being reported or are coming to fruition.

For a body like this Society, which cannot afford the technical staff needed to concentrate on sifting, condensing and recording all this U.S.A. as well as the general inflow of information, the position becomes more and more embarrassing. Not only should the cream of it all be given in SMOKELESS AIR, but everything that is of significance should be in our library, indexed for reference at any time, not only by and for ourselves, but also for the many outside inquirers who regard the Society as the one body in this country to help them. To do so is one of the Society's functions, and every effort is

made to live up to the standards expected of us, but in this, as in other services, it is no easy task.

The Lighter Side

After this rather anxious note, we think it might be appropriate to quote from a letter from a stranger who wanted to know what the Society was doing. Like all public bodies we receive our share of odd letters, but none has tried to put a point of view quite like this:

"We realize the disgraceful state that many of Britain's industrial towns are now suffering from and the need for a sympathetic Government to deal with the dilemma. The present Government, capitalistic, prehistoric, decadent and thrasonical, cannot be expected to give you any aid. It is apodictic that the tergiversation of the capitalistic big-guns in industry should be curbed."

The Fuel Efficiency Exhibition in Manchester

The arrangements for the "Fuel Efficiency in Industry and Home" Exhibition, to be held in Manchester in November next, are making good progress. As previously announced, the Exhibition is being held under the auspices of the Society and is being organized by Provincial Exhibitions, Limited. A strong national Advisory Committee has been set up, with representatives from many professional institutions, manufacturing and fuel production associations, and Government departments. A local committee, convened by the Society's North West Divisional Council is also being set up and will be largely concerned with the organization of meetings, lectures, and special visits to the Exhibition.

General inquiries may be addressed to the Society; inquiries about space to Provincial Exhibitions, Limited, City Hall, Manchester; and about local organization to Mr. H. Moore, Hon. Secretary, N. W. Division, N.S.A.S., City Hall, Manchester.

THE SOCIETY COMES OF AGE—II

Greetings and Appreciations

The Society has been honoured by receiving, on the occasion of its 21st Birthday, these congratulatory messages from leaders of many national interests. We are sure that all members will agree that these are an encouraging indication of the Society's standing and a stimulus for our continued effort. We also reprint, by kind permission, a felicitous leading article on the Society from "The Times," and conclude with a Postscript by Mr. Charles Gandy, Chairman of the Executive Council.

The Lord President of the Council (*The Rt. Hon. Herbert Morrison, M.P.*)

I offer the National Smoke Abatement Society my warm congratulations on its coming of age. I will not wish it many happy returns of the day, because I hope that it will not be many years before it will have succeeded so well that there is little or nothing more for it to do.

As a Londoner myself, smoke abatement is a subject on which I feel strongly, and it is no accident that one of the parent bodies from which the Society sprang was the Coal Smoke Abatement Society founded in London in 1899. Looking back over my own lifetime, I realise how remarkable the progress has been since the days when we took it for granted that every winter there would be a succession of pea-soupers. We have made great progress since then, and the Society has played a large part in bringing it about. But there is still a great deal to be done in London and other places. This is essentially a matter in which official action needs to be supported by the voluntary co-operation of public spirited men and women in educating the rest of us in the full and serious significance of the problem which has to be tackled. Important though the health and amenity aspects are, they are not, as

you know, the whole of the story. The work which your Society is doing for smoke abatement contributes in other ways to our economic and social well-being. The more efficient use of fuel will help, for example, to raise our standard of living and to increase our export potential; not least it will relieve the housewife of the needless drudgery which results from polluted air and from the inefficient use of household coal.

Congratulations on the Society's past record, and all good luck for the future.

The Chancellor of the Exchequer (*The Rt. Hon. Sir Stafford Cripps, K.C., M.P.*)

I commend the excellent work of the National Smoke Abatement Society. It is important that while we are building a happier, more prosperous and more productive country, we should not omit to make it a cleaner one too.

The Minister of Health (*The Rt. Hon. Aneurin Bevan, M.P.*)

I heartily congratulate the National Smoke Abatement Society on its coming of age. You have done much already to help form, and inform, public opinion; you are gaining the

support of the local authorities, and I hope the future will show a steady advance along practical lines towards the ideal of clearer and purer air, which you are fostering throughout the country.

The Minister of Fuel and Power
(*The Rt. Hon. Philip Noel-Baker, M.P.*)

I have always been an ardent believer in the work of the Society, and I am happy to send you my warmest congratulations on your coming of age.

Every public spirited person must detest the waste and disfigurement which result from the smoke evil. It is now one of my statutory duties to promote economy and efficiency in the use and in the consumption of fuel and power. Broadly, efficiency and smoke abatement go hand in hand. I have followed over many years the active propaganda which the Society has undertaken, and the real and growing results which you have achieved. But there is still much to do, and I am happy, therefore, to know that the Society is stronger in numbers and in influence than ever before; that your meetings and conferences are better attended; and that your work is ever more widely known. I am sure that you have a bright future before you, and I send you my warmest wishes for your continued success.

The Minister for Economic Affairs
(*The Rt. Hon. Hugh Gaitskell, C.B.E., M.P.*)

I followed with special interest the activities of the National Smoke Abatement Society while I was Minister of Fuel and Power and I am very happy to congratulate them on their coming of age.

Although I shall no longer be brought directly into contact with the Society in my official capacity, I sincerely hope that progressive improvement in the efficiency of fuel utilization and the abatement of atmospheric pollution will continue.

The Rt. Hon. Walter Elliot, M.P.
(*Minister of Health, 1937-39*)

Best wishes to the Smoke Abatement Society and its journal in their 21 years' battle, still continuing, for the simple privilege of breathing clean instead of dirty air.

The President of the Royal Society
(*Sir Robert Robinson, O.M.*)

On the occasion of the 21st birthday of the National Smoke Abatement Society I send you, on behalf of the Royal Society, our warmest wishes for the success of your campaign for smokeless air.

The scientific world has the liveliest interest in the application of scientific and technical knowledge in the utilization of our fuel resources and in the maintenance of the purity of the atmosphere in which we live.

The President of the Parliamentary and Scientific Committee (*Viscount Samuel, P.C., G.C.B., G.B.E.*)

I send my warmest congratulations to the National Smoke Abatement Society on its 21st birthday. Ever since, as a small boy in the London of the 1870's, I choked and coughed in the black fogs which were our bane every winter, and, later on, saw and detested the palls of smoke over the Black Country and the manufacturing towns of the north, I became an enemy of the belching chimney—whether industrial or domestic. As Chairman of the Royal Commission on the Coal Industry of 1925 I was glad to join in a report which included a vigorous section on the Pollution of the Atmosphere. That report revealed that every year three million tons of soot—equal in weight to three days' output of the whole of the then labour force of a million miners—were being discharged into the air, with most harmful effects upon the nation—its wealth, its health, and its temperament.

I write now as President of the Parliamentary and Scientific Committee to express its full support of the Society's campaign. On several occasions the Committee has made recom-

mendations, and its members have put frequent questions in the House of Commons, on the need for abatement of the smoke nuisance through the more efficient combustion of coal. It emphasizes that, although much improvement has been effected in recent years, there is still an urgent need for much more. It is true that the figure for the soot poured out into the atmosphere is less than the three million tons of 25 years ago; but, I am informed, it is still 2,400,000 tons. The whole of that should be eliminated. The Society's target is there. May it be fully achieved before the time of its Jubilee!

The President of the Association of Municipal Corporations (*The Rt. Hon. Lord Kennet of the Dene*)

We see every day evidence of the evil of unnecessary smoke, and of the need for a more active public opinion against it. So I offer a word of congratulation to the Society for what it has done for us in the past about this, and many happy returns of the anniversary, happy in the continuance of the good work.

The Chairman of the Convention of Royal Burghs of Scotland (*J. U. Primrose, Lord Provost of Perth*)

As one who loves the country, one of the features of town life which has always distressed me is the pollution of the air by furiously smoking chimneys. So much of the smoke is totally unnecessary and only by education of the public can this nuisance be eliminated. Such education is a lengthy process but great strides have been made by the National Smoke Abatement Society which have played a valiant part, recognised by all concerned with public administration, in making our towns more pleasant places in which to live. The value of their work is mirrored in the loyal support the Society receives from local authorities throughout the land.

On the occasion of the twenty-first anniversary of the Society's inauguration I wish to express appreciation of

your past work and hopes for future successful efforts.

The President of the National Farmers' Union (*Sir James Turner*)

I have great pleasure in sending our warm good wishes to your Society in its 21st year. I can assure you that farmers, horticulturists and indeed all who live and work on the land welcome and appreciate the great efforts your Society has made and is making in the struggle against avoidable smoke. Clean air ranks along with clean water as one of the great essentials if we are to get, as we must, the most out of the strictly limited resources of the countryside.

The President of the National Council of Women (*Mrs. Florence Earengay, B.A., J.P.*)

I welcome this opportunity to express very good wishes for the continued success of the National Smoke Abatement Society, which celebrates its "coming of age" this year. The Society has put smoke abatement on the map as a problem of national importance, of both social and economic significance, and the National Council of Women has always been glad to co-operate whenever possible in its progressive work.

Women who are acutely aware of the extra labour which smoke entails in the home, by its penetrating dirt polluting food, clothing and domestic equipment generally, should actively support the Society's untiring efforts to minimize this nuisance.

The President of the Sanitary Inspectors' Association (*J. C. Dawes, C.B.E., M.I.Mech.E.*)

Sanitary authorities recognise at least four fundamental problems in the wide field of public health. Sound and wholesome food, good housing; pure water and clean air. The first three have been, and are being successfully tackled on a big scale, but the fourth has received comparatively little attention, and but for the excellent, though unfortunately, uphill work of the National Smoke Abatement Society



Some of the Society's new transportable exhibits

over a long period of years, would have received even less. Just why this very important health service has not received adequate consideration cannot be discussed in a brief appreciation of the National Smoke Abatement Society's admirable record of achievement, but surely the time has arrived when it should receive from local authorities the same measure of support as other sanitary institutions to enable it to develop and extend its beneficent activities. There is, however, one thing to be said for the sanitary authorities. Practically the whole of the municipal refuse disposal plants provided during the past 20 years have been designed to prevent the discharge of black smoke or grit into the atmosphere.

coming of age. We recognise that the Society, in working to abate the smoke nuisance, is also striving to improve the standards of coal utilization. We fully appreciate the value of this work and especially because we are producers of smokeless fuel.

Through our association with organizations like the Coal Utilization Joint Council and the British Coal Utilization Research Association, in both of which we are a major partner, we are doing much that is in harmony with the Society's aims. Not only are we seeking to extend the use of modern solid fuel appliances which make less smoke, but also we are anxious to develop research which may solve the problem of burning bituminous coal smokelessly.

The Chairman of the National Coal Board (*Viscount Hyndley, G.B.E.*)

May I, on behalf of the National Coal Board, congratulate the Society on its

The Chairman of the Gas Council (*Sir Edgar Sylvester, K.B.E.*)

It is with great pleasure that I send my congratulations to the National Smoke Abatement Society on the

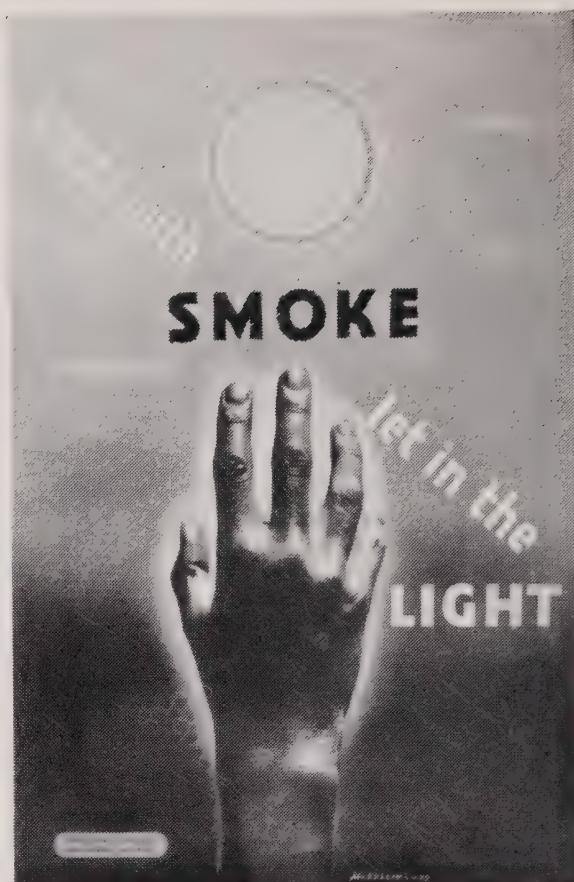
occasion of its "coming of age." I do so with the greater readiness because the gas industry has always been keenly interested in the work of the Society and has regarded with sympathy its efforts to make the community conscious of the fact that the damage and waste caused by smoke can be avoided. As Chairman of the Gas Council, it gives me great pleasure to know that the Society's work has been actively assisted in many ways by the industry to which I belong. Developments in the use of gas and coke, both of which are smokeless fuels, have done, and are doing, much to give our towns a purer, healthier atmosphere. This is borne out by the fact that the domestic consumption of gas has increased by about 45 per cent. during the last decade or so, while the increase in the industrial consumption over the same period is in the region of 70 per cent.

Much, however, remains to be done before, with the advent of the smokeless age, the National Smoke Abatement Society can say that its work is completed. Until that time arrives, may even greater success reward its efforts.

The Chairman of the British Electricity Authority (*The Rt. Hon. Lord Citrine, K.B.E.*)

The British Electricity Authority are consuming about 30 million tons of coal a year in their power stations and are the largest single user of fuel in this country. They are, therefore, vitally concerned with the question of smoke abatement, and the electricity supply industry can already lay claim to have done more to prevent atmospheric pollution than any other group of consumers. Whereas the efficiency of an ordinary domestic fire is only about 16 per cent., the efficiencies achieved by the boiler plant in a modern power station are between 85 and 90 per cent., and the efficiency of the whole process of electricity generation approaches 30 per cent.

The attention of the authority's technical experts and engineering staff is devoted continuously towards im-



One of the Society's posters

proving the efficiency of combustion in their power plants, and the problem of smoke elimination is tackled with the most modern and scientific equipment available. The installation of plant for extracting grit and ash from the flue gases is now standard in all new power stations and is accepted as an obligation to the community. All new stoker-fired boilers are provided with mechanical grit and dust arrestors of the highest efficiency, and boilers burning pulverized fuel are being equipped with electrostatic precipitators which are capable of extracting from 95 to 98 per cent. of the grit which would otherwise escape into the atmosphere. The seriousness with which the Authority view this problem is indicated by the fact that the installation of this equipment represents an annual capital cost to the Authority of some £4,000,000.

The "electric age" is steadily becoming the "smokeless age," and the increased use of electricity by

industry as well as in the home has done much to clear the air. As the consumption of electricity increases throughout the country, so the smoke pall over our industrial centres and cities will steadily decrease.

When it is borne in mind that the Authority's programme of new generating plant construction envisages the gradual elimination of the older and less efficient plants and the concentration of generation in power stations employ-

ing the most efficient and up-to-date methods of combustion, the immense contribution of the electricity supply industry to smoke abatement appears in its true perspective.

The Authority can, therefore, not only congratulate the National Smoke Abatement Society on its "coming of age" and applaud the great endeavour it has made to rid our skies of pollution, but can also assure it of wholehearted support in the work which still remains to be done.

Leading Article Reprinted from

"THE TIMES"

Saturday, March 25th, 1950

LESS SMOKE

The late Hieronymus Karl Friedrich, Baron of Münchhausen, of unforgettable memory, has recorded how he found the fog in England so thick that he cut himself a cube of it to take home. He perhaps saw the fog before it reached its densest forms; but if he could return to-day he might well be disappointed. He would find that London's 10 m. chimney pots seem to be losing their power to produce a real old-style "peasouper," as the spread of gas, electricity, and other improvements is making the British air cleaner. He would even find an assembly of public-spirited busybodies congratulating themselves on the twenty-first anniversary of their conspiracy to deprive the Englishman of his right to blacken his neighbour's washing and ruin his lungs and buildings by burning whatever he likes in any way he likes in his own hearth. These fumifugists, as John Evelyn, their earliest inspirer, might have called them, prefer to be known as the National Smoke Abatement Society.

Beginning a generation earlier, in the face of much derision, as three separate groups in London, Sheffield, and Scotland, they first came together at Buxton in 1929. They already had one Act of Parliament to their credit. They

have since launched the only journal in the world devoted to atmospheric pollution; they have stimulated much technical research and inaugurated the training of stokers in fuel economy; they have widely popularized the ideas of smokeless zones and public regulation of fuel-burning appliances; and they have enrolled in their ranks some 400 local authorities, including nearly all the larger and smokier towns. Public opinion has been won over; and it has all been done on an annual budget only now attaining £3,500.

The fumifugists have been powerfully helped by events. Ever since Evelyn's day, said Dr. J. Bronowski in a recent broadcast to Europe, "the attack on fog has been based on the need to prevent waste as much as on any moral indignation or on the need for clean lungs and clean linen." This he called "a very English touch; England is a country where everyone is always anxious to make it clear that his good deeds are also useful and economical." The war made the English aware of the economic value of such good deeds. The sight of more than 10m. tons of coal disappearing into the air each year was more than could be borne, when life was cheap and coal so dear. In 1945, says Dr. Bronowski, "when we made a special drive for fuel efficiency in

Britain's factories, we reduced soot over the whole country by 10 per cent. in a single year." How many people, he asked, know that "Britain is planning to change over most of her power stations to powdered coal in the next ten years, and yet is not calling this important step a ten-year plan for power or economy or anything"? But unofficial fumifugism is as much needed as ever before, to prod and poke and nag at the authorities and the directors of industry. Tall stories about the English fog are passing with the tall chimneys themselves. The remaining damage to health, to architecture, property and plant life, the danger to aircraft, the waste and filth have still to be much abated.

Postscript

By Charles Gandy

Chairman of the Executive Council

A coming of age, when the years have brought healthy growth, is always a happy event. It is especially so when attended by so much goodwill from those about us. The character of the messages which have been addressed to the Society on its 21st birthday, and the distinguished and widely diverse positions in our national life of the writers, will encourage the many now actively associated in one way or another with the smoke abatement movement, and are especially pleasing to those of us who remember its small beginnings.

For this goodwill we owe much to the vision and sound commonsense of the Society's founders, including its first two Presidents, Dr. Des Voeux and Alderman Melland, and others with them in the previous movements centred in London and Manchester. Much was already known of the ill-effects of smoke, the sickness and mortality, the endless drudgery of all-pervading dirt, the drab and dreary expanse of huge areas in which people had to live and work and bring up their families in our larger towns. Medical services, new homes and hospitals, the dispersal of the better off to distant

suburbs, the endless extension of transport and other services—in such ways millions of money, much voluntarily subscribed, were being (and still are) expended, with little or nothing in those days, and little enough even now, on prevention.

The pioneers of smoke abatement knew that the evil must be attacked at its source. It was not enough merely to shake public apathy, though that has been no trifling task. They set themselves to a patient study of the facts—by co-operation with the health authorities, with industrialists, with research workers and fuel technologists, by organizing classes for stokers, and in other practical ways they laid the foundation for that objective study of all aspects of the problem of the means for its solution, which year by year has been carried on in the developing organization of the National Smoke Abatement Society. The Society could by its effective propaganda stimulate demand, but research and production in the fuel industries, gas and electricity

THESE ARE THE THINGS THAT SMOKE DOES



... but this is not all. Write for literature and read how Britain's towns and countryside can be made clean and smokeless.

NATIONAL SMOKE ABATEMENT SOCIETY
Sandos House, Buckingham Gate, London, S.W.1.

Another of the Society's posters

undertakings, the manufacture of industrial and domestic appliances, had to meet the demand, and their representatives have for many years been present at our Council and Committee meetings and annual conferences.

It has been very noticeable that people once interested retain their enthusiasm and their cumulative experience and knowledge are at the Society's disposal. Its head office at Chandos House, Buckingham Gate, Westminster, now with a staff of five, under the able guidance of its popular General Secretary, Mr. Arnold Marsh, who has been with us from the beginning, is in constant touch with whatever concerns us both in this country and in others, such as the U.S.A. and

Canada, where similar work goes on. Correspondence, requests for lectures, for information and advice, Press notes and articles, exhibitions, increase month by month as the Society's influence expands. The work must go on. No other body of people, not even a Government department, is so qualified by knowledge, experience and organization to carry on such work. But unless some new source or sources of funds become available the Society's work will inevitably be brought to a standstill. We feel that we are on the threshold of success—with all else that is needed for its achievement, and the goodwill we so much value, but with an almost empty purse. Can no one help us to fill it? After all, it *is* our 21st Birthday!

NEWS

Hot Water Supply—Many readers will be interested in the report on hot water supply recently published by H.M. Stationery Office. (National Building Studies, Special Report, No. 8: Inquiry into Domestic Hot Water Supply in Great Britain, Part 1, Distribution of Water Heating Appliances and their use in Winter.—1/- net.). From this report one learns that 15 per cent of households have not water heating appliances whatever, and 28 per cent have nothing but a copper—thus 43 per cent of all households have no hot water “on tap.” Between them, London and Scotland account for almost half of these households. Out of a sample of 5,997 households 68 per cent had solid fuel appliances, 43 per cent gas appliances, 11 per cent electric appliances, and 1 per cent hot water laid on. Among the many interesting details to be learned from the figures is that whereas 17 per cent of London households have independent solid fuel boilers, this figure drops to 11 per cent for the south and east, 3 per cent for the midlands, Wales and Scotland, and 1 per cent for the north of England.

An Air Pollution Bibliography—The January, 1950, issue of the Meteorological Abstracts and Bibliography of the American Meteorological Society contains an annotated bibliography of articles and publications on atmospheric pollution. This is given in chronological order, beginning with *Fumifugium* in 1661, with a subject index, notes on earlier bibliographies, and a list of periodicals containing articles on atmospheric pollution. Of SMOKE-LESS AIR the note says “Contains pertinent, but usually brief articles on smoke abatement and atmospheric pollution.” Many of the Society's publications and Conference Proceedings are listed. Altogether about 250 items are listed, and thus the bibliography cannot be regarded as exhaustive. It is however, a well-balanced and most useful one.



The New Alkali &c. Works Order—This new order came into force on March 25th, 1950. It extends the number of manufacturing processes controlled under the Alkali, etc., Works Regulation Act, 1906. The effect of the Order is to add volatile organic sulphur compounds and fluorine to the list of noxious or offensive gases,
(continued on page 121)

WILL MELLAND

IT is with the deepest regret that we have to record the death, at Buxton, on May 14th, 1950, of Will Melland, the Society's first Chairman and Treasurer, and its President from 1943 to 1945. Since then serious illness had prevented him from taking any further part in the work of the Society he had helped to found.

To say merely that he helped to found the Society would however be most misleading. Without his efforts and sustained determination it is improbable that there would be the Society we know. He became Chairman and Honorary Treasurer of the small and weak Smoke Abatement League of Great Britain in Manchester soon after it was revived after the 1914-1918 war, guided it successfully in the right direction, and made possible the fusion with the London body, the Coal Smoke Abatement Society, which, after its great fight for new legislation seemed likely to dissolve. The prospects for a voluntary smoke abatement organization, active and effective and yet able to pay its way, seemed very bleak in 1927 and 1928, and what happened, and how the present Society was formed and began to grow, was related—by a sad coincidence—in the "Coming of Age" article in our last issue, when brief tribute was paid to the part played by Will Melland.

But we must once again try to ensure that the newer members of the Society appreciate, as do the older ones, that more than anything else, it was the wise understanding of Will Melland that set the course, and his sure hands at the wheel, that steered the young Society safely past the many shoals and rocks at the beginning of its voyage. Though he spoke effectively on occasion he was not primarily a public speaker; nor was he an extensive writer or a man anxious to push forward his own



ideas. He was rather the Chairman, listening to, guiding, and co-ordinating the ideas of others; the Treasurer working hard to bring in the urgently needed funds, and just as carefully watching how they were spent; the practical business man seeing that the Society kept its feet on the ground, even when it was peering upwards for the stars—and withal the idealist helping it to find them.

He devoted much time and energy, personally, for the Society, with meetings, correspondence, and quiet, persuasive, individual talks, and at first with the day to day details of organization. When the future was touch and go he persuaded two personal friends to join with him in guaranteeing to subscribe £50 a year each for three years to give the new organization the chance to make good that it was in fact able to take under his leadership. He was always friendly and considerate, and liberal in mind and heart. His many other interests, boys' clubs in the slums of Ancoats, the playing fields movement, the campaign for Sunday games in the city parks, the bringing of good music and drama to the people of Manchester, all give an indication of the values he held fervently, and yet with that leavening of practical realism that brought progress and success to so much that he fought for. It was sometimes said of him that he was his city's wisest philanthropist. On the

Manchester City Council, where he was at first a Councillor and then an Alderman, and among his unnumbered friends in many walks of life he was regarded not only with respect and admiration, but with a warm and real affection. It was maybe, his rare qualities of character and personality

that provided the essential cementing force in the formation and building up of the Society. Without it, immaterial though it may seem at this distance of time, something different might have been built, but it may be doubted whether it would have been so firm and so lasting.

NEWS—*continued from page 119*

the discharge of which into the atmosphere is controlled; to add fluorine works and acid sludge works to the list of scheduled works liable for registration under the Act; and to extend the range of processes carried out in sulphuric acid works, bisulphite works and cement production works, the carrying out of which render the works liable for registration under the Act.

The original Draft Order which was published in October last year also proposed to regulate fumes containing carbonaceous particles from black production works, and to impose registration on carbon black works. However, as a result of representations made at a public inquiry into the subject matter of the Draft Order, the Minister has decided not to include carbon black in the present Order.



The March meeting of the Midlands Joint Advisory Council for the Abatement of Atmospheric Pollution was held in Warwick and Leamington. The Council was given an official welcome by the Mayors of the two towns, and visits were made to works, first to see the prototype of a newly-patented grate for preventing smoke emission from vertical type boilers, and secondly to inspect the working of a new type of filter for washing flue gases. This was in operation at a foundry and is in the form of a wet washer, subjecting the flue gases to a wave and spray action.



We would like to record, on behalf of the Society, our congratulations

and good wishes to Alderman F. W. Perry, of Smethwick, who has recently been elected as a Freeman of the Borough. Alderman Perry has been a representative of his authority to the Society during the whole of its existence, and was mentioned in our coming-of-age article in the last issue as one of the few members still active who attended the inaugural conference at Buxton in 1929.



In addition to Mr. Ritchie, of Edinburgh, whose retirement is mentioned elsewhere, the Executive Council of the Society has recently lost the services of two other members: Mr. Stewart Swift, of Oxford, who has left local for national government service, and Mr. William Tillcock of Edmonton, who has retired after nearly 43 years service in local government. To both these good friends the Society extends its best wishes for the future.



The first step in the legal procedure for setting up Salford's first smokeless zones has been taken by the City Council, which has passed a resolution declaring three areas to be Zones Nos. 1, 2 and 3 for the purposes of Section 22 of the Salford Corporation Act, 1948. The date for enforcement will have to be fixed with regard to the need and time taken to install grates capable of burning smokeless fuels in a number of houses and of gas and gas-ignition points in others. This will be aided by the Corporation to the estimated extent of £10,000. A full report on Salford's action and plans will be given at the Margate Conference by Alderman G. H. Goulden.

District Heating

A Review by A. J. Cousin, M.Inst.F. of Some Recent Papers

DURING and since the late war there has been much discussion of the possibility of the utilization of district heating in areas of existing towns, or in the construction of new towns, or the reconstruction of devastated areas.

Recently three instructive papers have been given on this subject :

- (1) Joseph Rawlinson (Chief Engineer and Surveyor, L.C.C.) before the Conference in Geneva of the International Union of Local Authorities, September, 1949.
- (2) Donald V. H. Smith before the Incorporated Association of Architects and Surveyors at Caxton Hall, December, 1949.
- (3) A. E. Margolis before the Institute of Fuel, March, 1950.

The more efficient use of our fuel supplies is of increasing importance and any expedient that will provide the necessary heat in domestic premises and avoid the use of the inefficient open coal fire will naturally make a great appeal to those interested in the prevention of pollution of the atmosphere. Fuel can be burned much more efficiently in a large modern central plant where the products of combustion can be dealt with effectively, and moreover much labour involved in the distribution of fuel, the firing of boilers and the removal of ash is thereby avoided. It may be recalled that the Simon Report in 1946 summarized the position in the following words :

“We are using excessive quantities of coal : we are providing inadequate heating in the houses : we are pouring out masses of soot and tar into the atmosphere. In our view we cannot afford to maintain our low standards of heating ; we cannot afford to continue to depress and destroy the life of our cities by smoke pollution ; we cannot

afford to waste our limited national coal reserves.”

Early district heating schemes were established years ago both in the U.S.A. and to a less extent in this country, both as direct heating schemes or by the exhaust steam from small back-pressure electric generating stations. Progress in this country has not been rapid, possibly from the cheapness of coal and its derivatives gas and electricity, and possibly for the same reason, domestic heating appliances are generally less efficient in this country than elsewhere.

As the result of damage caused during the late war, large areas have to be reconstructed. This extensive rebuilding and also the erection of new towns have directed attention to the possibilities of district heating and many schemes are in progress, mainly direct heat, but also a few thermal-electric schemes.

Joseph Rawlinson

Mr. Rawlinson points out that the preparation of schemes has been hampered by the absence of information as to costs and there is little data on which to base capital and working costs. Many schemes have turned out to be more expensive than estimated and it is essential to proceed with strictest economy or there is a danger that costs will be beyond the means of tenants. He considers the large electric generating station to be the most economical source of heat, utilizing some of the large part of the total heat energy of the coal that normally passes to waste in the condenser cooling water. Where a large station is not appropriately situated it may be possible to construct a small station, but difficulty may arise in balancing the heat and electricity load. Where no thermal-electric source is available, in certain circumstances where the area contains a large pro-

portion of block buildings, Mr. Rawlinson considers that a straight thermal plant would be justified. Owing to the comparative high cost of electricity in this country, he does not think that the heat pump would be so satisfactory as the source of heat as it has proved to be in the U.S.A., Switzerland, etc., where electricity is available at low charge from hydro-electric sources.

The cost of distribution of hot water in insulated piping may be responsible for a large proportion of the total cost and much research is necessary to arrive at the most effective and most economical system.

Mr. Rawlinson considers that a temperature of 65° F. (18° C.) for living-rooms and 50° F. (10° C.) for bedrooms to be appropriate and thinks that a flat-rate charge could be imposed for this service. He has some doubts however, as to whether hot water supply could be met by a flat-rate charge. The supply of hot water might be left to traditional types of hot water heaters under the control of the tenant, or alternatively the hot water supply might be supplied by meter. In a London scheme referred to 450 therms per annum including 200 gallons of hot water at 60° C. per week were supplied to each dwelling at a charge of 7s. 3d. per week, but it is clear that the assessment of charges will be a matter of some difficulty.

Mr. Rawlinson refers to district heating schemes operating in the U.S.A. and in the U.S.S.R., Germany, France, Switzerland, Italy, Czechoslovakia and Denmark.

Donald V. H. Smith

Mr. Smith refers to the slow progress of district heating in Great Britain in comparison with the extensive progress made in the U.S.A. where there are over a hundred installations serving central areas in large cities and 123 housing estates erected by the Federal Housing authorities equipped with district heating, and in many cities on the continent. He refers to the varying efficiency of various methods of heating from as low as 15 per cent. in the open coal fire to as high as 78 per cent. in thermal electric power schemes.

While he sees little possibility of obtaining heat supplies from the larger condensing electric power stations, except possibly by the installation of additional back pressure turbines, he envisages the possibility of converting some of our smaller less efficient power stations into back pressure plants and utilizing the exhaust steam for heating the surrounding district. Mr. Smith stresses the importance of planning and insists that the efficiency of a district heating scheme may be increased by bearing in mind at an initial stage the requirements of a scheme and in the construction of the buildings themselves and siting them, and in this respect he sees the greatest possibilities of district heating in the new towns. He considers housing estates of a few hundred houses too small to support a district heating scheme unless a large proportion of the labour costs can be charged to another source. He refers also to the problem in a heat electric scheme of balancing the heat and electricity loads that would require the incorporation of hot water heat accumulators.

Mr. Smith refers to the contribution district heating would make to the reduction of the pollution of the atmosphere in that combustion can be more efficient, and products dealt with efficiently at the central station whatever its character. In conclusion he emphasizes that it must justify itself on an economic basis.

A. E. Margolis

Mr. Margolis points out that ready-made heat for space heating and hot water supply can contribute very largely to the comfort and health of the population and can at the same time avoid the ill-effects of atmospheric pollution. Electric and gas heating although having many conveniences are too expensive, in particular electricity, which he estimates would cost 87 pence per therm, uses larger quantities of fuel and may create a load very inconvenient for the undertaking to handle. He refers to the great increase in the efficiency of generation of electricity in condensing stations, but concludes that although fuel consumption has

reached the low value of 11,500 B.Th.U per KWH, any further considerable increase in efficiency is unlikely. It has been computed that the demand for electricity may reach the figure of 30,000 M.W. between 1965 and 1975 requiring possibly a further 30 million tons of coal a year, which it would be difficult if not impossible to provide. He refers also to the increasing difficulty of siting large condensing stations where the necessary cooling water is available, and in view of the difficulties likely to be met that would be accentuated by any great increase in the electric heating load, he suggests that an endeavour should be made to develop heat-electric generation on an appreciable scale.

Obsolescent condensing power stations appropriately situated might be wholly or partly converted to work non-condensing and provide the heat for a district-heating scheme. With a view to balancing the heat and power loads, back-pressure and condensing sets could operate in series and/or heat storage in hot-water accumulators could be used.

Mr. Margolis illustrates the accumulator forming part of the Hamburg plant and the accumulator in course of erection in connection with the Pimlico Housing Estate, Westminster, to be heated by exhaust heat supply from the Battersea Power Station across the river.

Mr. Margolis is not favourably disposed to the heat pump as a source of heat under conditions pertaining in this country, and contends that the economic limitations of a straight heat supply make it essential to combine heat supply with power generation. Optimum economy is obtained by heat-electric generation with high initial pressure and low pressure hot water distribution. The provision of an accumulator permits the heat and electricity to be varied over a wide range, and on warm days when the heat demand is less than the exhaust heat output of the turbines, air-blast cooling can be brought into play.

Mr. Margolis refers to the importance of planning in relation to district heating and to the importance of including in new towns a heat-electric



THE PIMLICO HOT WATER ACCUMULATOR

The accumulator is a 29 ft. diameter tank, 126 ft. high, enclosed in a 16-sided glazed steel tower 36 ft. in diameter and 140 ft. high. Behind, almost completed, are some of the flats to be served.

(N.S.A.S. copyright photo.)

station to supply the needs of electricity and heat of the community, and at the same time save a large proportion of the coal that would normally be utilized.

The Pimlico Estate in Westminster is an interesting experiment and it may serve to provide data for the development of many schemes in the future. Exhaust steam is to be taken from back-pressure turbines at Battersea and the heat and electric loads balanced by a tall hot water heat accumulator encased in glass shown in the illustration.

A further question arises as to whether in developed areas this additional public utility can be installed without unreasonable expense, whether it would have to be given a monopoly of space heating leaving gas and/or electricity for cooking, power, lighting, wireless, etc., or whether in such conditions it is applicable on an economic basis only to large blocks of flats and offices, and factories.

Hot Water Charges

One of the points mentioned by Mr. Rawlinson and discussed at some length by Dr. G. E. Foxwell in the *Municipal Journal* of November 25th, 1949, is whether it will ever be a sound proposition to supply hot water at a flat-rate charge. Commodities supplied at a flat rate are apt to be wasted; cold water frequently is and hot water would probably be wasted to a greater extent; and this may give rise to additional capital costs in the form of meters or restrictive calorifiers. An instance quoted records that in similar circumstances hot water supplied free was used to the extent of 50 gallons a day and 30 gallons a day only per house where it was paid for.

In Great Britain we have no native inexhaustible supplies of hot water waiting to be piped to the habitation of man, as has Reykjavik, and it is essential that much more precise information be obtained as to sources of heat, systems of piping and costs in general before we are committed to vast expensive schemes. Many have proved much more costly than anticipated, almost beyond the reach of the tenants, and it is essential that all schemes should receive the closest scrutiny.

A number of these and other problems were propounded by the Subcommittee on District Heating of the Egerton Committee and will be answered when further data has been obtained. The three papers here summarized throw some light on this problem of district heating, that is exercising the minds of many people at the present time. The advantages of a supply of heat and hot water at low cost without any pollution of the atmosphere is apparent, but it has a chance of general adoption only if it is economically sound and many problems remain for solution. We may be much behind-hand in this country and experience in other countries does not necessarily provide the basis for costing a scheme installed in Great Britain.

It is essential that our coal resources should be used with the utmost efficiency and the prospect of utilizing a part at least of the heat that is lost in power stations is attractive. Whether it is a sound proposition to convert some of the small obsolescent plants to heat-electric plants and whether it is practicable for new areas only or also fully developed areas remains to be ascertained.

In the *Municipal Journal's* feature "The Private of an M.O.H." a recent entry read: "Attended a meeting on smoke abatement. Valuable work is being done in this country by the National Smoke Abatement Society in keeping constantly before the public the damage done to health and property by atmospheric pollution. It is an uphill job . . ."



The School of Public Health, University of Michigan, recently offered an interservice training course on air pollution. The course covered identification of the problem, tools used in investigation and determination of solution of problems, and approach employed in solution of some of the problems involving common industrial and other sources of air pollution. For the three-day course a fee of 5 dollars was charged.

The Divisions in Conference

THE Society's Divisional Councils have been very active during the past month or two, holding their annual general meetings and conferences. First of the series was an interesting meeting of the Yorkshire Division in York, on March 28th, where the meeting was preceded by lunch in the Guildhall by invitation of the then Lord Mayor, Mr. J. B. Morell, and was followed by a visit of inspection to York Minster. Particular point was given to this visit because of the new appeal for funds to repair the Minster's stonework, which has been badly eroded, largely by the sulphurous gases and deposits. Members finally ascended the tower of the Minster to see for themselves the considerable amount of pollution—industrial, railway and domestic—from which this comparatively isolated city of York suffers. The long, twisting climb to the top of the tower was well worth while, and once again it proved how useful it is to get above the smoke and look down, in order to appreciate its extent.

The North West Division held its annual general meeting in Manchester on May 25th, with a showing of films following the business meetings. The Divisional Council is at present concerned with the Fuel Efficiency Exhibition to be held in Manchester in November (see page 111) and is being responsible for the convening and activities of a local advisory committee, which, among other things, will arrange conferences, meetings, and organized visits to the Exhibition.

At Aberdeen

Next, in Aberdeen, on June 1st and 2nd, the Scottish Division held its first two-day conference—a successful venture attended by 80 to 90 members. Papers were read by local speakers—the Medical Officer of Health for Aberdeen, Dr. H. J. Rae; the Director of Town Planning, Mr. J. E. Barlow,

and Mr. A. D. Edmond, head of the Department of Mechanical Engineering, Robert Gordon's Technical College. The Conference was attended by the Society's National President, Dame Vera Laughton Mathews, who at the final session gave an address on "Preventing Smoke in the Home." Visits were made to the famous Aberdeen grit works, or granite quarry, and to other places of interest. Generous hospitality was given by the Lord Provost of Aberdeen and the Corporation—and incidentally, the Lord Provost is an excellent upholder of the famous Aberdeen myth, telling a number of excellent stories, including even the one in which the term "rigid economy" is defined as "a dead Aberdonian."

To the regret of all Mr. Allan Ritchie, who has retired from his post as Chief Sanitary Inspector for Edinburgh (and has taken an appointment as Food Hygiene Officer, Department of Health for Scotland), did not wish to be re-elected as President. The new President is Bailie Taylor of Glasgow, and his pleasant, efficient control of the meetings augers well for the future. Mr. John Innes, of Paisley, was elected Vice-President, and Mr. Norman Fraser Hon. Secretary in succession to Mr. John Trail, who retires after several years of successful and not always easy office. Smoke abatement in Scotland, to judge from this conference, is very much alive and all are anxious to make progress.

Heat Wave on the Tees

The Scottish Conference was held in glorious summer weather, but at Middlesbrough on June 6th, the North East Divisional Council held its annual general meeting at the height of the heat wave. Never, one believes, have members of the Society looked so warm and thirsty as during their most interesting tour by motor-bus of Tees-side during the afternoon.



Members of the Yorkshire Division viewing York from the roof of the Minster.

The business meeting, attended by over 60 members and representatives, was held in the Council Chamber of the Town Hall in the morning, and was followed by an informative paper by Mr. A. H. Rushworth, Chief Sanitary Inspector of Billingham, who has on his hands one of the most complex air pollution problems in the country. (We hope to report Mr. Rushworth's paper more fully in the next issue). The Conference was invited to lunch by the Mayor of Middlesbrough, who is also Chairman of the Sanitary and Baths Committee and to an unusually welcome tea after the afternoon tour. During the tour delegates were given a bird's-eye view of Tees-side from a high viewpoint to the south, and were driven round and through Billingham to see for themselves the vast size of the I.C.I. and other industries in the area. An inspection was made of the Newport Bridge, the first vertical lift bridge to be built in this country, and the largest in the world. Members climbed to the upper parts of the complicated structure, and had the privilege of having it raised for their

benefit — the navigation span is 270 feet in length, and rises from 21 feet above river level to 120 feet. The moving weight of span and counterweights is 5,400 tons—exclusive of the added and not inconsiderable weight on this occasion of the North-East Division.

After its first year of life the Division is in a very healthy and vigorous condition. Mr. W. Gray, of Newcastle, has had to give up the post of Hon. Secretary, but retains that of Hon. Treasurer, and Mr. G. Tate, of Ashington, was elected to the former

office. Alderman J. Chapman of Newcastle, and Alderman P. S. Hancock of Gateshead were re-elected Chairman and Vice-Chairman. A development of importance is that a committee, branch, or section of the Divisional Council may be set up for Tees-side; a matter on which discussions are at present being held. The procedure to be adopted is of some importance to the Society as it would be a precedent for similar devolutionary organization.

The annual meeting of the East Midlands Division is to be held in Nottingham on July 6th.



Another view of York from the Minster tower

(Photos by courtesy of "The Northern Echo.")



Watson House

Centre for Gas Research

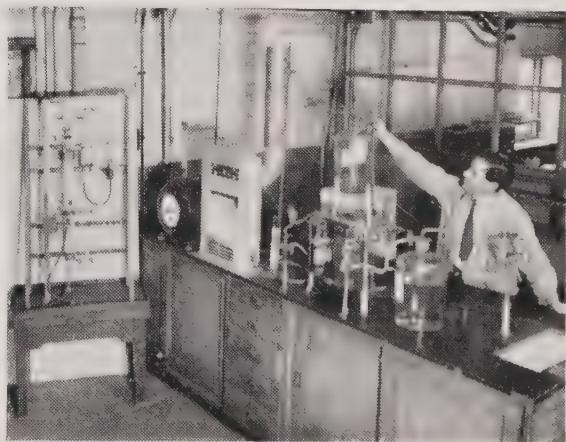
ON the bank of the Thames, where it disconcertingly flows almost northwards at Fulham, and adjoining the Fulham Gas Works, is the gas industry's most important centre for utilization research, Watson House. Named after the late Sir David Milne-Watson, for many years Governor of the Gas Light and Coke Company, Watson House seems to be much too modest a description for an establishment that occupies more than four acres. One approaches the long-fronted three-storey main building, and later finds that there are substantial wings leading off from this, with still more buildings further back. They will tell you at Watson House that it takes three days to make a complete inspection of all there is to see, and certainly the chief impression from an afternoon's visit is not in the interesting detail that has been absorbed, but in the overall pattern of an extensive and smooth-running organization that is dealing efficiently with every aspect of the research, development work, testing, and training necessary for continued progress in the use of gas and coke.

The range of work in progress can be appreciated by observing the number and variety of laboratories. On the utilization of the two fuels there are laboratories devoted to hot water, space heating, cookers, industrial appliances and coke. Then there are meter, stores-testing and gas quality

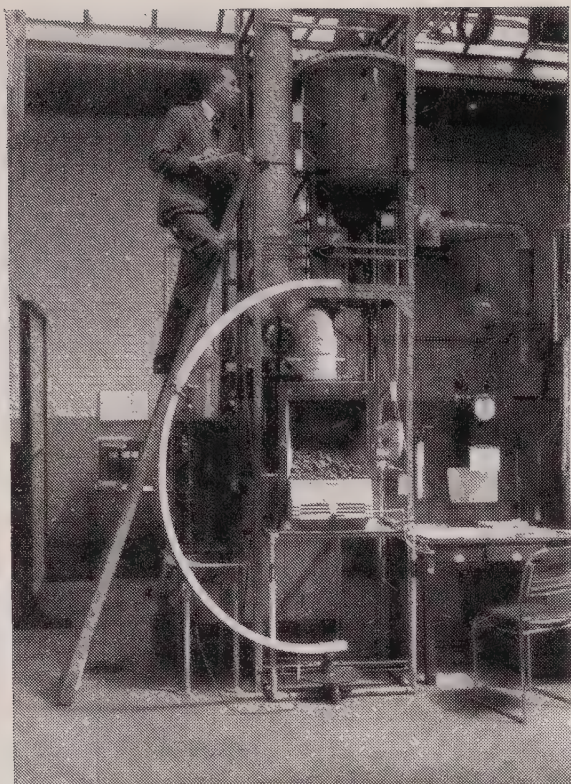
laboratories; others for chemical and photometric work, a photographic studio and dark room. Next may be noted the workshops—industrial workshops, a foundry, plating, polishing and carpenters' shops, and even one for clock repairs.

Watson House is concerned not only with research and testing, but also with the training of salesmen, fitters, and other staff, and so there are training shops, classrooms, and a lecture theatre. Finally, in addition to offices, drawing offices, kitchens and canteens, there is a large display hall and a showroom for industrial appliances.

The comprehensive range of work being done is as difficult to epitomize as the premises themselves, but we may take the easy way of quoting from a



Testing flue vapours at Watson House



In the Coke Laboratory.

booklet issued to visitors :

- (1) The properties of gas and its efficient utilization.
- (2) The quality of materials used in supplying and burning gas.
- (3) The safety, efficiency and construction of appliances using gas and coke.
- (4) Factors leading to improved practical efficiency, performance, ease of maintenance and installation.
- (5) The design of home and industrial appliances.
- (6) Training the lads of to-day to make them the men of to-morrow.
- (7) Training all staff, including fitters, representatives, etc., to keep them up-to-date and refresh them with new developments and new information.

Although the whole of Watson House may be regarded as of importance from the smoke prevention point of view, the space heating and coke laboratories are of particular interest. In the former we find work on the development of new designs of gas fire and of flueless

heaters, with the detailed testing of every factor of performance, reliability and safety. Some things noticed, at present in their early stages, cannot yet be reported, but mention may be made of further work on the balanced-flue heater, which, fixed on an outside wall, takes the air required for combustion from the outside atmosphere, and returns the productions of combustion in the same way.

Of special interest to us is work in progress, in both the space-heating and the coke laboratories, on a development that uses both gas and coke in the one appliance. In this the familiar Fulham coke fire has fitted into its front a small but efficient gas fire, which when not in use is neatly hidden behind a hinged cover. Combined gas and coke fires were on the market long before the present improved types of fire had been developed, and the experience of the writer with one over many years is that the combination has very considerable merits. It is hoped to publish more details of the new fire later on.

It is in the coke laboratory itself that so much of the research was done on



Testing a gas cooker grill

the improved fires, of which we believe the Fulham fire was the first, that are helping to make domestic smoke prevention a practical possibility. Work is still in progress on these and other smokeless fuel appliances, and the coke laboratory also carries out a share of the testing of other solid fuel appliances that is required if they are to be included in the official list of approved appliances.

Watson House is the utilization research headquarters of what was the Gas Light and Coke Company and is now the North Thames Gas Board.

But, although it is not, in the general sense of the word, a national institution, it acts as a "Centre" for technical information for other Boards of the gas industry and Government departments and is certainly national in its approach to the problems with which it deals; its achievements have a national value as well as serving the special needs of its own area. It is in close contact with the appliance manufacturers and their research and development sections, so that there is a full exchange of information and a mutual, helpful liaison at all stages.

Handbook on Coal

Coal—Production, Distribution, Utilization. Produced by the Coal Industry Society and the Institute of Fuel, edited by P. C. Pope. Published by Chapman and Hall for Industrial Newspapers Ltd. 12s. 6d.

With a growing realization of the dependence of our social order on adequate supplies of artificial heat and an increasing appreciation of the manner in which our basic fuel has been and is being washed, the Coal Industry Society and the Institute of Fuel have done well to publish this work. Each chapter has been contributed by an acknowledged expert in the particular aspect of the subject and the book has been edited by Mr. P. C. Pope. It is concisely and lucidly written and gives a survey of the industry from the coal-face to the industrial and domestic uses of coal, gas and electricity, in language that will appeal either to the technologist or to less-informed members of the community. As Lord Hyndley and Dr. Townend say in the preface, it is hoped that the book will prove useful to members of the trade following courses of study, to business men and women who wish to know more of the industry and to users of coal at home and abroad.

The first chapter explains clearly the nature of coal and the method of its

formation, and the groups in which it is classified, while the second chapter sets out the location of the coalfields of Great Britain and the geological processes that have been responsible for their formation. The third chapter describes the opening of a mine, from its preliminary bores, the sinking of the shaft, the layout of the mine, the methods of coal winning and the installation of machinery. Chapter four describes the crushing, screening, washing and general preparation of coal for the market while chapters five and six describe the seaborne and rail transport of coal, and chapter seven the distribution of coal by road and chapter eight the storage of coal.

Succeeding chapters deal with the analysis of coal, its use for steam raising and types of boilers, carbonization and gasification, in horizontal retorts in intermittent vertical chambers, continuous vertical retorts and in coke ovens; low temperature carbonization and gas producers and carburetted water gas; oils and chemicals produced from coal; the domestic use of solid fuel, of gas and of electricity.

The book is copiously illustrated and should form an excellent source of information for anyone interested in the coal industry.

SMOKELESS HOMES



A New Boiler

A NEW domestic boiler, which has given very high efficiencies under test, is that designed by Mr. A. C. Hazel, primarily for use with "Coalite," but also suitable for other fuels such as gas coke. It is manufactured by C.S.A. Industries Ltd., of Warwick, and can be supplied either in the firm's well-known "English Rose" style cabinet, to match other kitchen equipment, or in an alternative "Warwick" cabinet.

Among the special features of the Hazel boiler is a simple switch control which actuates both the air inlet and the flue damper; a bucket-type ash container fitted with handle for ease and cleanliness in emptying, which is needed only once every 7 to 14 days; a temperature indicator; and a stainless steel work top with simmering plate and space for casserole heating. There is a shaking grate with a section that

allows a dead fire to be dumped down into the ash container. Official tests on gas coke, burning 2.57 lbs. per hour over a 12-hour period, gave an efficiency of no less than 75.9 per cent. At a higher rating an efficiency of 69.5 per cent. was obtained.

The price in the "English Rose" cabinet is £47 10s., and in the Warwick cabinet £39 10s. A detailed brochure may be obtained from the manufacturers.

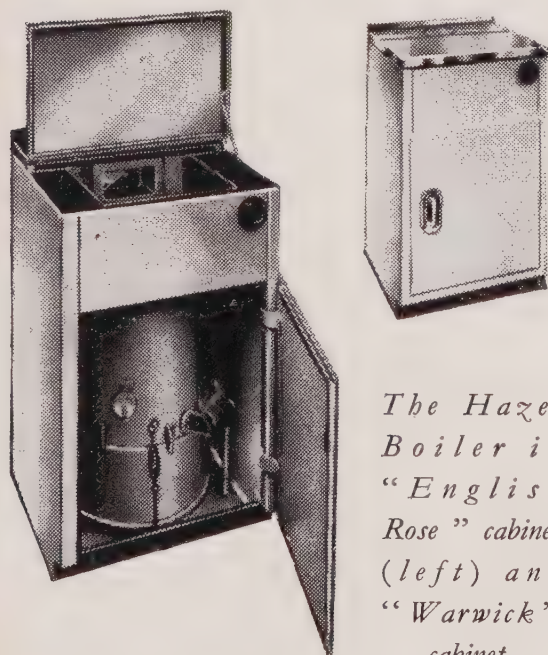
Electrical Aid

The British Electrical Development Association are again publishing, for the first time since the war, their magazine *Electrical Housekeeping*. This is produced in the modern, bright and cheerful style, and the first number contains much of interest for the go-ahead housewife. The magazine is distributed free from electricity show-rooms.

Stanmore Development

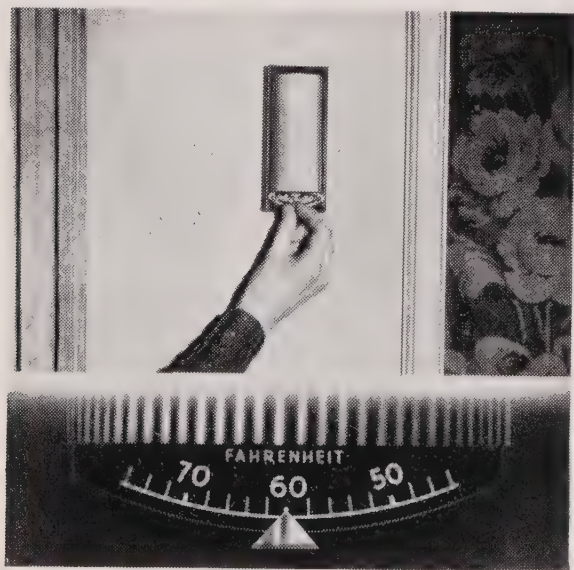
In our Autumn, 1949, issue we mentioned the experiment being carried out at Stanmore, Middlesex, by Radiation Ltd., on "whole house" heating. As was then described, one of two houses was being heated by a unit in the form of a gas chimney furnace, and in the other a solid fuel cabinet was installed, incorporating a new type of down-draught furnace, with heat exchanger. In both cases warm air was forced into each of the rooms to be warmed; the temperature being regulated by a wall thermostat.

Radiation Ltd. have now published a brochure, *Stanmore Development*, in which the results of the extensive tests,



The Hazel Boiler in "English Rose" cabinet (left) and "Warwick" cabinet.

and the conclusions drawn, are given. The gas heating system was in continuous use throughout a complete heating season, the outside temperature ranging from 20° to over 90° F. It was found that a gas-burning appliance rated at 30,000 B.Th.U./hr. was capable of maintaining throughout the house a mean temperature of over 40° F. above outside air temperature under typical wintry weather conditions. A high degree of uniformity of temperature distribution throughout the house was attained, with variations of not more than 1 to 2° F. Variation of temperature in different parts of the same room was also satisfactory. For economy in fuel the room thermostat can be reduced from say 65 to 60° F. for over-night running, when there will be very little call for heat from the appliance, the heat reserve of the structure supplying most of what is necessary.



Setting a room thermostat in a Stanmore house. Below, the dial enlarged. This is the only control required.

Most people prefer to sleep in a cool bedroom, and no difficulty was experienced in arranging for this, the bedroom door and the warm air register being closed and the window opened. In the morning when the window was closed and the door and warm air register opened, comfortable temperatures were quickly regained, a temperature rise of 10° F. being obtained in less than ten minutes.

With the solid fuel cabinet heat

instead of gas, again on the forced warm air system, there were only minor differences in temperature distribution and flexibility.

Other experiments were carried out using a warm air panel system, in which the warm air flows in channels between the ceiling of the ground floor rooms and the floor of the bedrooms, and in the walls. This system is capable of maintaining very constant room temperatures and would be excellent for a background system, but has a very slow response to thermostat setting changes. Tests were also made with a hot water radiator system, but again the flexibility of the system was considerably less than with the warm air register systems.

Fuel Consumptions

The heat required to maintain various house temperature rises with different weather conditions has been determined, and from this basis the fuel requirements for an average year calculated. From the tests made at Stanmore and elsewhere it has been shown that for a house of 1,000 sq. ft., insulated and ventilated to the Egerton standard, the following fuel consumptions are required for the given standards of service.

To maintain the whole house at 60° F. at all times, the living-room and dining space at 67° F. for six hours per day and the bedrooms at 65° F. for four hours a day, and to provide 250 gallons per week of hot water at 140° F. at the tap would require :

850 therms of gas per annum using the Gas Cabinet Heater or the Gas Chimney Furnace and the New World R.12/20 Storage Water Heater.

4 tons of coal, coke, anthracite, etc., using the Solid Fuel Cabinet Heater.

In addition, 90 therms of gas are required for summer water heating provided by the built-in gas circulator.

One of the chief objects of the Stanmore experiment was to obtain additional data on the design of the heating appliances. This has been successfully accomplished, and the report gives much interesting information about these. Copies of the

brochure may be obtained from Radiation Ltd., 7 Stratford Place, London, W.1, who, by the way, extend a cordial invitation to local authorities and others interested in whole house warming to inspect the Stanmore houses. Inquiries should be made to the Public Relations Officer at the address above.

Solid Smokeless Fuel

As mentioned in the last issue, the Society's Publicity Committee is considering the solid smokeless fuels position, and it has asked for a note to be given in these columns on the different types of such fuels that are at present available. A series of more detailed articles on the subject is being considered, but by way of introduction the following notes are given.

The Natural Smokeless Coals—These include anthracite and a number of other South Wales Coals of the "dry steam" class, that in volatile matter content lie between anthracite and the smoky bituminous coals. Some of these low-to medium-volatile coals produce a little smoke, but others may be regarded as smokeless for all practical purposes. All these fuels, and especially anthracite itself, are in short supply because of their high export popularity. In the home these fuels are mostly used in domestic boilers and stoves, but they can be burned with excellent results in the new kinds of open grate.

Coke—Gas coke is at present the most easily obtained smokeless fuel, and is now both unrationed and purchasable from any retailer. Some grades of gas coke, especially the dry-cooled vertical retort cokes, will burn easily on stool-bottom and similar old style grates, but others need the greater and controllable draught provided by the new "approved" grates and stoves. Gas coke is supplied screened in sizes suitable for open fires or closed appliances, including domestic boilers. "Hard" or oven coke, produced from coke ovens primarily for use in blast furnaces, is also available locally. Ignition by gas is always advisable for coke.

Low Temperature Carbonization Fuels—These are semi-cokes obtained by carbonizing coal at temperatures lower than those used at gasworks. Their volatile matter content is therefore higher and they will ignite more easily and recover more quickly than fires of coke or smokeless hard coal. Although they will burn readily in any kind of grate or stove, it is more economical to use the new types.

"Coalite" is the most familiar of these fuels, and can be obtained in practically every part of the country through the usual coal merchant. The present annual production is around 315,000 tons, and much more would be used if it were available.

Although other excellent semi-cokes have been manufactured in the past we believe that the only kind at present available is "Rexco." This is also a highly reactive fuel, manufactured by a process quite different from the "Coalite" process, and in which the pieces of smokeless fuel are of the same size and shape as the coal nuts from which it is produced. The amount being manufactured is very much less than the demand, but inquiries about supplies should be made to Charles Franklin, Limited, Belgrove House, London, W.C.1., or, in Scotland, to Clarke, Taylor and Co., Limited, 116 Pilgrim Street, Newcastle-upon-Tyne.

Both of these fuels are of course usable in boilers and closable stoves, and "Coalite" is also available in a special smaller "boiler nut" size.

Compressed Fuels.—"Phurnacite" is an excellent smokeless fuel, suitable for open fires, boilers and stoves. It is made from fine anthracite or steam coal, and is carbonized to remove the smoke from the pitch binder. "Uncarbonized ovoids" and most forms of briquette are extremely smoky in use, partly from the coal and partly from the pitch, and from our point of view are only to be deplored.

The prices of the different smokeless fuels needs fuller discussion. Briefly, they are controlled prices and vary in different parts of the country according to freight charges on natural fuels or on the raw coals used.

Smoke Prevention Abstracts

A Special Abstract Record of the Papers read at the First National Air Pollution Symposium, sponsored by the Stanford Research Institute, November 10th and 11th, 1949, at Pasadena, California, U.S.A.

134. Preparation, Collection and Measurement of Aerosols, La Mer, V. K. (Dept. Chem., Columbia Univ.). Describes experimental work on the preparation of monodisperse (of equal size) particles of varied composition and the investigation of their optical properties, filtration methods and efficiencies and similar factors.

135. Determination of Concentration and Size of Particulate Matter by Light Scattering and Sonic Techniques, Gucker, Jr., F. T. (Dept. Chem., Indiana Univ.). A knowledge of the concentration and size of the individual particles is frequently necessary in the study of aerial disperse systems. New instrumental methods have been applied to the solution of these problems, the development, applicability and limitations of which are the subject of the paper.

136. The Occurrence of Ice-Crystal Nuclei in the Free Atmosphere, Schaeffer, V. J. (General Electric Research Lab., Schenectady, N.Y.). The occurrence of particles in the atmosphere which will act as nuclei for the growth of ice crystals has been studied as part of work on weather modification by seeding of clouds. The influence of forest fire smoke, spores and bacteria, and industrial smokes as sublimation nuclei are discussed.

137. A Continuous Recording Condensation Nuclei Meter, Vonnegut, B. (General Electric Research Lab., Schenectady, N.Y.). Describes an automatic recording condensation nuclei meter which shows promise of being a valuable tool for investigations of meteorological phenomena and air pollution problems. Further work is desirable to provide an accurate calibration of the instrument in terms of

absolute nuclei concentration.

138. Some Techniques for Sampling and Identifying Particulate Matter in the Air, Crozier, W. D., and Seely, B. K. (New Mexico School of Mines). The impactment method of collection of air-borne particles is suitable for sizes down to about the limit that can be satisfactorily worked with under the microscope. Chemical techniques have been described that are capable of yielding considerable information about the material collected, and seem capable of extension to a wide variety of material. Some applications of the techniques to special problems are mentioned.

139. National Trends in Air Pollution, McCabe, L. C. (Chief Officer, Air and Stream Pollution, Bureau of Mines). The reasons for a general failure so far to control air pollution in the U.S.A. are surveyed, and include waste of effort and misguided enthusiasm; unwillingness to pay the price of control and to wait for results which must be long-term; belief by industry that control costs too much and to opposition and tactical diversion of attention to minor problems. The future is more promising because of the strengthening of health considerations by the Meuse Valley and Donora disasters; by greater attention being given by scientific bodies—eight conferences in 1949 are listed; developments in industrial equipment including supersonic and electrostatic precipitation, filter collectors, sulphur recovery, utilization of fly ash, and waste heat recovery. The author discusses what he calls the folklore of the problem, which consists of erroneous beliefs and arguments minimising different aspects and blaming "nature," as in temperature inversions.

Factors for successful pollution control in the U.S.A. are considered.

140. Sampling of Industrial Stacks and Effluents for Atmospheric Pollution Control, Silverman, L. (Sch. of Public Health, Harvard Univ.). Methods and techniques for obtaining satisfactory stack samples are discussed. Some basic considerations which must be made in obtaining reliable stack samples and a discussion of the methods of sampling effluents in the atmosphere are presented. A need exists to-day for simple measuring techniques for evaluating atmospheric pollution. It is difficult to use one single method because of the nature of the contaminants.

141. Techniques Employed in the Analysis of Los Angeles Smog, Magill, P. L. (Stanford Res. Inst.). Describes techniques developed and used in an investigation of the Los Angeles atmosphere, the principal objectives of which were to determine what materials were responsible for poor visibility and what for eye irritation. The instruments used for collecting particulate matter and gaseous impurities from the atmosphere and the effect of this matter on visibility are considered and finally the opinion is given that it is due to the mixture of contaminants and not a single impurity.

142. Some Instrumentation Problems in the Analysis of the Atmosphere, Washburn, H. W., and Austin, R. R. (Consol. Eng. Corp.). The analysis of polluted atmospheres is difficult because of the minute concentrations that exist and the large number of substances that may be present. Several different types of analytical procedure are discussed, of which the first is a titration method (Titrilog) for the continuous measurement of sulphur dioxide. The second is a method of employing a mass spectograph, possibly with concentrated samples.

143. Reduction at the Source, Larson, G. P. (Los Angeles Air Pollution Control Dist.). Reviews methods of setting standards for pollution control ordinances: density of emission and limitation of specific contaminants.

In Los Angeles County better control has been obtained by a new type of regulation based on mass rate of emission. The ordinance provides for an allowable discharge in pounds per hour depending on total material used. A nuisance statute is also desirable and consideration should be given also to licensing of fuels. The administration of such an ordinance and the problems of the installation of control equipment are considered.

144. Removal of Particulate Matter from Industrial Effluent, Sproull, W. T. (Western Precipitation Corp.). The paper reviews the different methods of removing dust and fume from gases under the headings: (a) baghouses and filters, (b) washers and scrubbers, (c) centrifugal collectors, (d) electrical precipitators, and (e) ultrasonic agglomerators. Application of these to industrial processes are discussed and modern combinations of two types of collector in a single installation.

145. Meteorology as a General Factor in Air Pollution Problems, Beers, N. R. The reasons for the interest of meteorologists in air pollution are given and reference is made to the dispersion of pollution, both natural and industrial, the effect of temperature inversions, and the control of pollution by variation of output (at Trail, B.C.) according to meteorological forecasts.

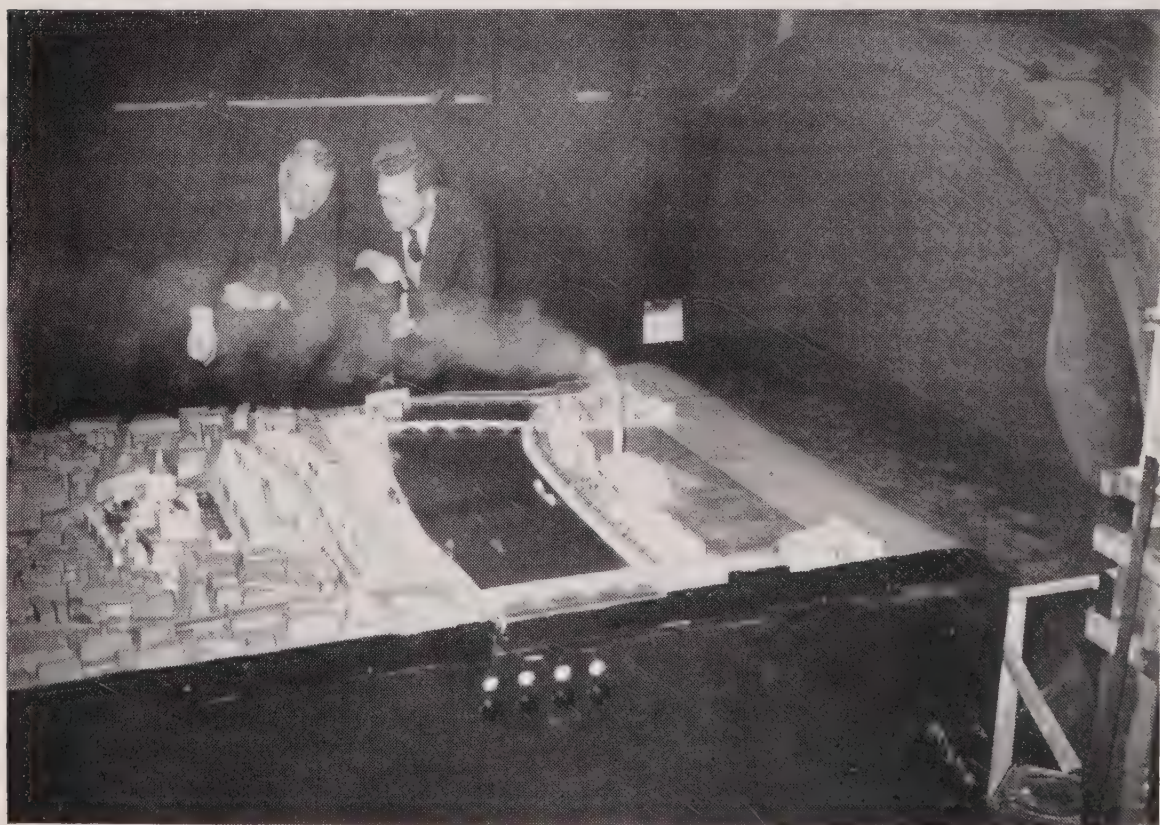
146. Experimental Study of the Effect of Air Pollution on the Persistence of Fog, Newberger, H., and Gutnick, M. (Pennsylvania State Coll.). Describes the methods and technique used in a recent experimental study using artificial fogs, and the results obtained. It is found that fog density is, under otherwise identical conditions, not affected by variations in air pollution such as are ordinarily found over continents, but that there is a continuous increase in fog duration with increasing air pollution. The stabilization of fogs in more polluted air is explained by the effect of electrostatic charges. Under otherwise identical conditions a smog lasts some 60 per cent. longer than does a clean fog.

147. Atmospheric Pollution Caused by the Diffusion of Waste Industrial Gases, Hebley, H. F. (Pittsburgh Consolidation Coal Co.). Reviews the situation with reference to the siting of industry and concludes that much more research needs to be carried out on the micrometeorological effects on the discharge of waste products to the atmosphere. It will require the combined efforts of a number of professions to present a satisfactory method of attack.

148. Visibility and Air Pollution, Steffens, C. (Univ. of New Mexico) and Rubin, S. (Stanford Res. Inst.). Information about the physical characteristics of suspended particles in polluted air can be obtained by measurement of their optical properties. The first part of the paper deals with the method used in Los Angeles for measuring the attenuation coefficient, which is directly related to the visibility, and with some conclusions that can be drawn from the results. The latter part is concerned with the results

of measuring the attenuation coefficient at different wavelengths, since such measurements yield an estimate of the size distribution of the aerosol.

149. The Economics of Air Pollution, Gibson, W. B. (Stanford Res. Inst.). The paper approaches the subject from standpoints of the economic loss from air pollution, the direct economic costs of air pollution control, and the point of diminishing returns in abatement work. There is evidence that the direct economic loss from pollution, excluding all social and indirect costs, may be in the order of \$1,500,000,000 annually in the U.S.A. There is also evidence that the total economic cost of air pollution control approximates about \$100,000,000 a year. It is considered that less than 25 per cent. of the existing pollution-abatement programmes are producing or will produce a net financial return, or will even recoup costs of installation and operation. The balance of costs must be considered as being in the interests of public welfare and as con-



A working model, at the National Physical Laboratory, Teddington, of the Bankside Power Station and the City of London in the wind tunnel. Experiments are being made on the effects of the smoke from the station chimney.

tributing to the overall improvement of working conditions. For individual companies pollution-abatement cannot generally be regarded as economic. The problem is one of translating scientific "know-how" on air pollution into methods of control and abatement that will fall within an established point of diminishing returns for each situation.

150. Air Pollution and Community Health, Kehoe, R. A. (M.D.) (Dept. Prev. Medicine and Indust. Health, Univ. of Cincinnati). The nature and effects of common air-borne materials on the health of those who breathe them are largely matters of speculation since unequivocal evidence is meagre. Such facts as can be brought to bear on the subject are derived from (a) the literature of industrial toxicology, medicine and hygiene, (b) disasters such as the Meuse Valley and Donora, and more restricted but comparable incidents, and (c) statistical correlation of apparent trends in disease records. The difficulties of relating specific pollution to specific effects, the question of the effect of two or more contaminants together, and other relevant factors are discussed. Mention is made of the evidence that the toxic effect of vapours may be increased by particulate matter which presumably acts as a vehicle to bring the vapour into intimate contact with the pulmonary alveoli.

151. Physiologic Effects of Chemical Contaminants of the Atmosphere, Foulger, J. H. (Haskell Lab. of Indust. Toxicology). Discusses a theory of physiologic stress, which states that if recovery from a stress that causes adjustments from the normal of internal environment (respiratory rate, blood flow and pressure, etc.) is not complete when the stress recurs, giving a pattern of deterioration and partial recovery, this will lead in time to deterioration greater than that caused by the initial stress. Neither the Meuse Valley nor the Donora incident requires the postulation of any mysterious new toxic agent, nor is any departure from existing physiologic knowledge needed to explain the clinical picture or the distribution of injuries among the exposed populace. The absolute quan-

titative relationship between the "active" concentrations of each of a number of chemical components and the physiologic outcome of their simultaneous action is not known nor with so many possible combinations is likely to be known. The true test of health hazard to the general public from any particular atmosphere is the ability of this atmosphere, when inhaled, to produce physiologic deterioration in exposed persons, and especially those having respiratory or cardiovascular diseases. No degree of "cleaning up" of our cities can be considered satisfactory from the medical point of view unless it results in an atmosphere, the breathing of which imposes no physiologic load upon the least resistant inhabitant—the sufferer from respiratory or cardiac disease.

152. Effects of Fluorides on Man and Animals, Largent, E. J. (Kettering Lab. of Applied Physiology, Univ. of Cincinnati). The author observes that the pollution of the atmosphere with fluorides, as the result of industrial operations, may contaminate nearby vegetation and induce chronic fluorosis among cattle grazing thereon. Persons working in environments in which hydrofluoric acid is present in the air have not suffered from irritation of the eyes or respiratory tract until the concentrations exceeded 3 p.p. mill. Neither have there been complaints from people who have knowingly ingested quantities of fluorides that exceeded the maximum quantities that communities in the U.S.A. can anticipate from air-borne fluorides. It seems unlikely that human discomfort or ill-health will result from any general pollution of the air with compounds of fluorine derived from present normal industrial relations.

153. Impurities in the Air and their Influence on Plant Life, Zimmerman, P. W. (Boyce Thompson Inst. for Plant Research, Yonkers, N.Y.). An account of investigations to identify the characteristic effects on species of plants of known gases under controlled experimental conditions. The gases used included sulphur dioxide, hydrofluoric acid, chlorine, hydrogen sul-

phide, ammonia, mercury vapour, ethylene, and carbon monoxide. With alfalfa plants exposed to low concentrations of SO_2 (0.1 to 0.2 p.p.m.) a number of interesting observations are recorded.

154. The Action of Sulphur Dioxide on Vegetation, Thomas, M. D., Hendricks, R. H., and Hill, G. R. (Dept. Agric. Res., Amer. Smelting and Refining Co.). The extent of injury to the leaves of plants by SO_2 is determined primarily by the amount of the gas absorbed through the stomata. The time-concentration relationships and the absorption-leaf destruction relationships are discussed with respect to environmental factors such as light intensity, atmospheric humidity, and time of day, and also with respect to stomatal apertures, and the carbohydrates in the leaves. The effect on yield, due to various amounts and types of leaf destruction by SO_2

fumigation, is shown to be the same as that due to equivalent leaf destruction by clipping off the leaves. Sublethal doses of SO_2 may have no effect at all, or only a temporary effect on the rate of photosynthesis of alfalfa, depending on the concentration employed.

155. The General Problem of Air Pollution and Plants, Went, F. W. (Earhart Plant Res. Lab., California Inst. of Technology). A short survey of the problem and a number of factors and recent observations and investigations. It is suggested that man-made air pollution is at least partly caused by the upsetting by man of the natural cycle of assimilation and dissimilation; apart from fuels, much wood, paper, vegetable and animal waste of many kinds is burned, generally ineffectively, instead of undergoing natural decomposition by micro-organisms, thus producing air pollution and robbing the soil of its natural source of fertility.

Correspondence

The Underloaded Boiler Again

*The Editor,
Smokeless Air.*

Sir,

It would be presumptuous of me to offer advice on how your journal should be conducted as Mr. Batey of Sheffield does in the Spring issue.

My feelings are that SMOKELESS AIR is not a technical journal. As the Society's official organ, its readers include many non-technical adherents to the movement whose continued interest and support is a great asset. The dearth of contributions to "Smoke Inspectors' Case Book" is likely to continue under the influence of criticism such as his.

The contribution "The Story of an Underloaded Boiler" was not, and made little pretence of being technical; prefacing it as "pseudo" is superfluous. The technicalities involved were elementary and too obvious to warrant stressing them. The story was told as an interesting episode directing atten-

tion to the shortcomings of works managements in the matter of boiler operational efficiency.

Our critic's reference to instrumentation prompts an answer. The article made it plain that the presence of instruments would have materially assisted in diagnosing the trouble quickly. They are invaluable when properly used, and in the case referred to this would have been more desirable, under the circumstances, than balanced draught. The real reason for preferring the latter, since learned, must not be related here.

If the story offended by showing an engineer in a bad light, it also indicated how Smoke Inspectors' efforts are sometimes hampered, and Mr. Batey, I am sure, will agree that the term is often misused in its application to boiler plant staff. The April issue of "Power and Works Engineering" carries a pointed article on this subject.

Of least importance is the alleged "attempt to show what a clever chap F.T.S. is." The author, in his anxiety to impress this virtue upon the reader hid his light under the *nom-de-plume* of
F.T.S.

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—see also next page

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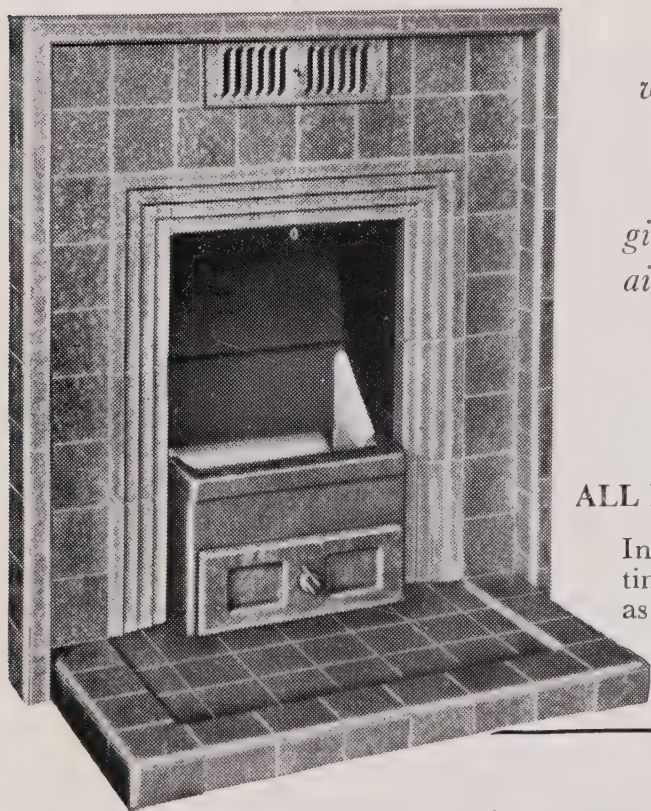
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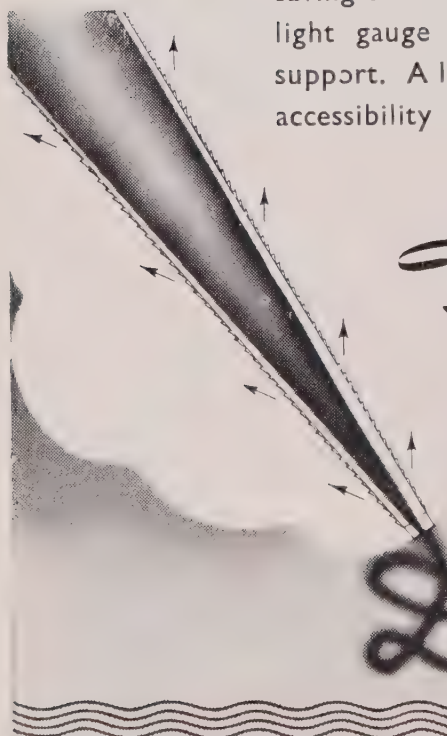
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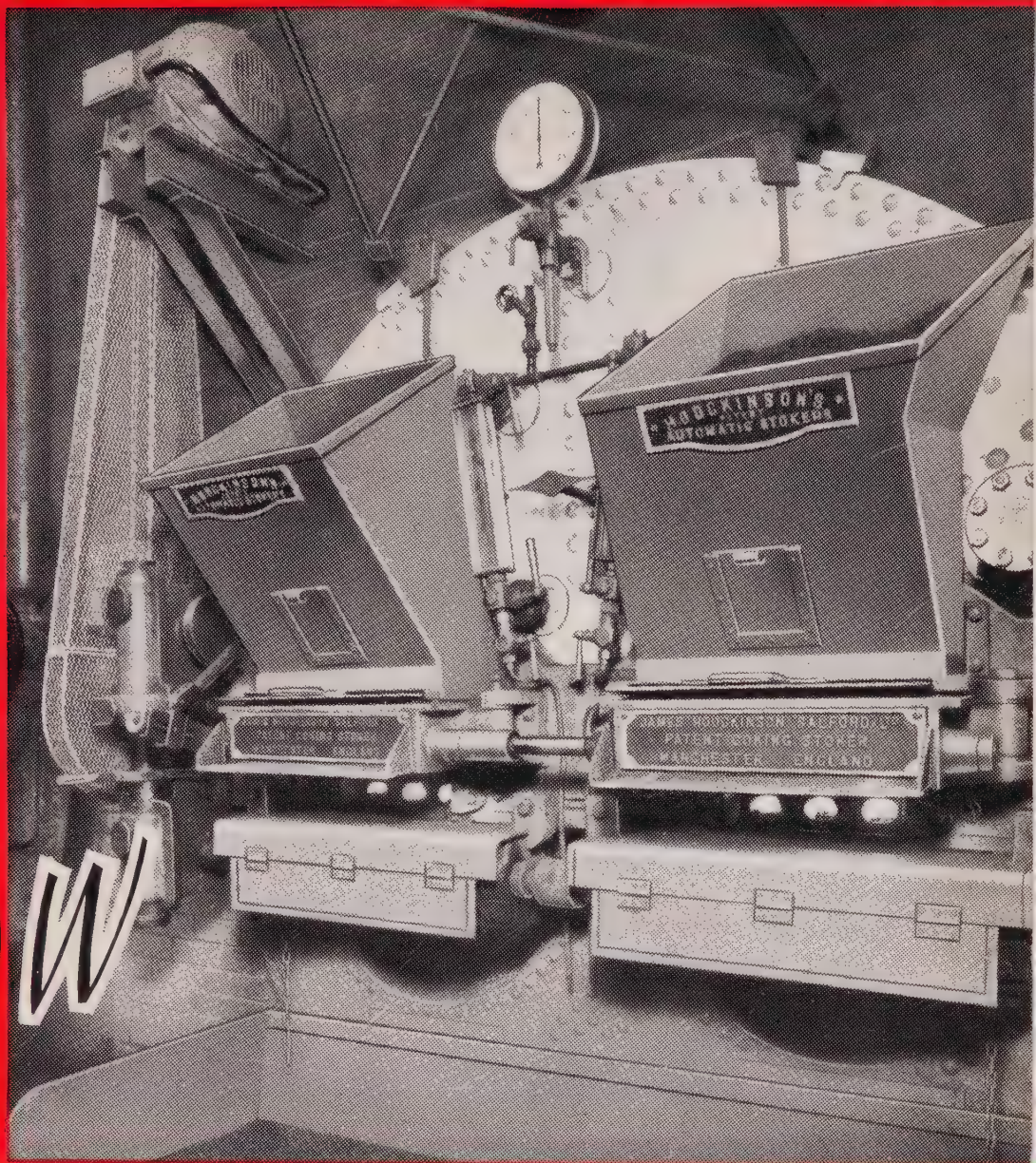
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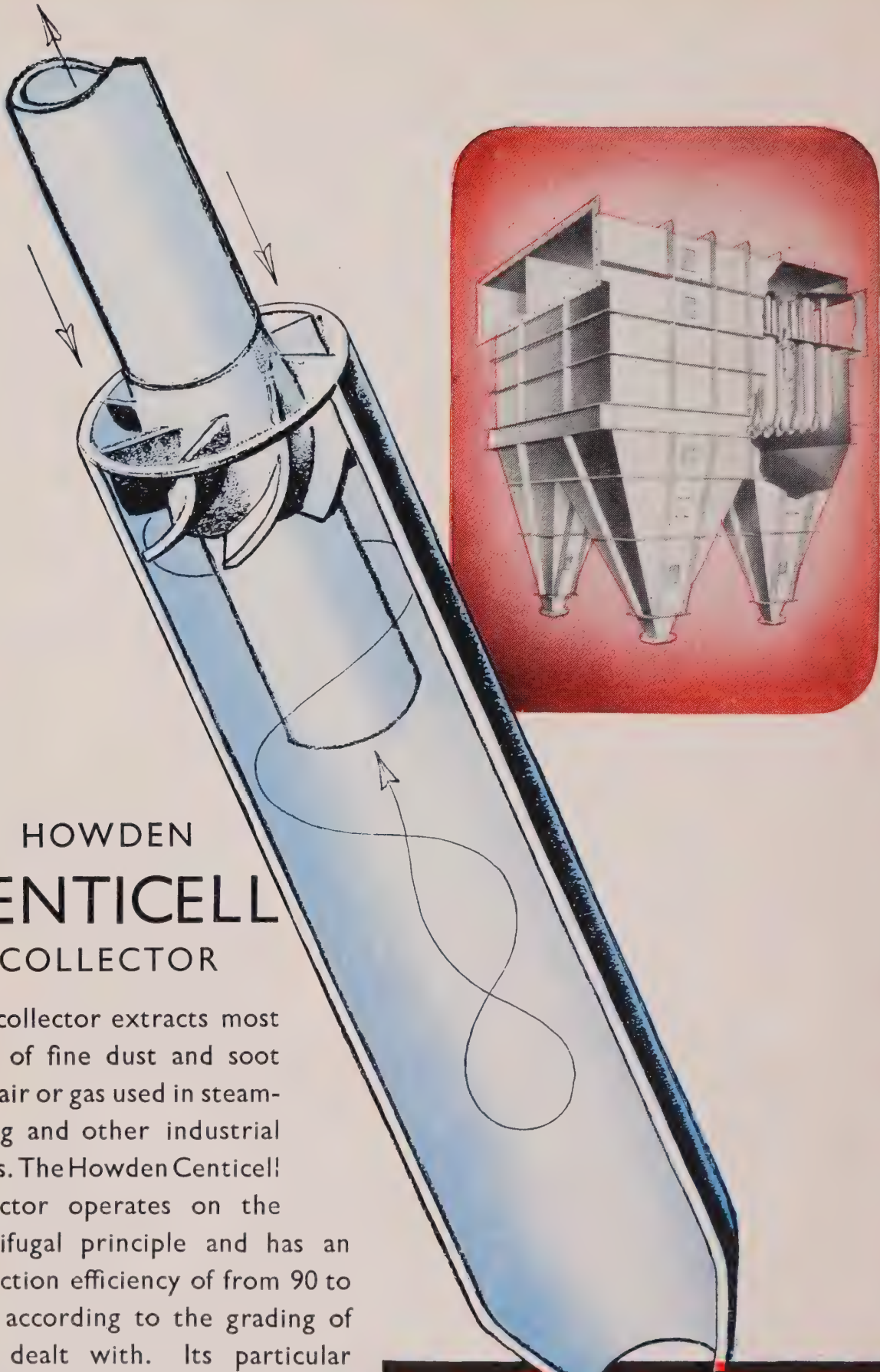
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 75

AUTUMN

1950

ONE SHILLING

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Smoke on Tees-Side

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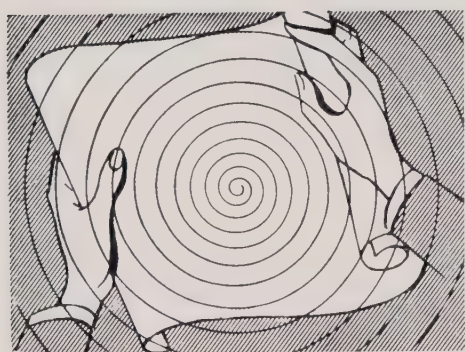
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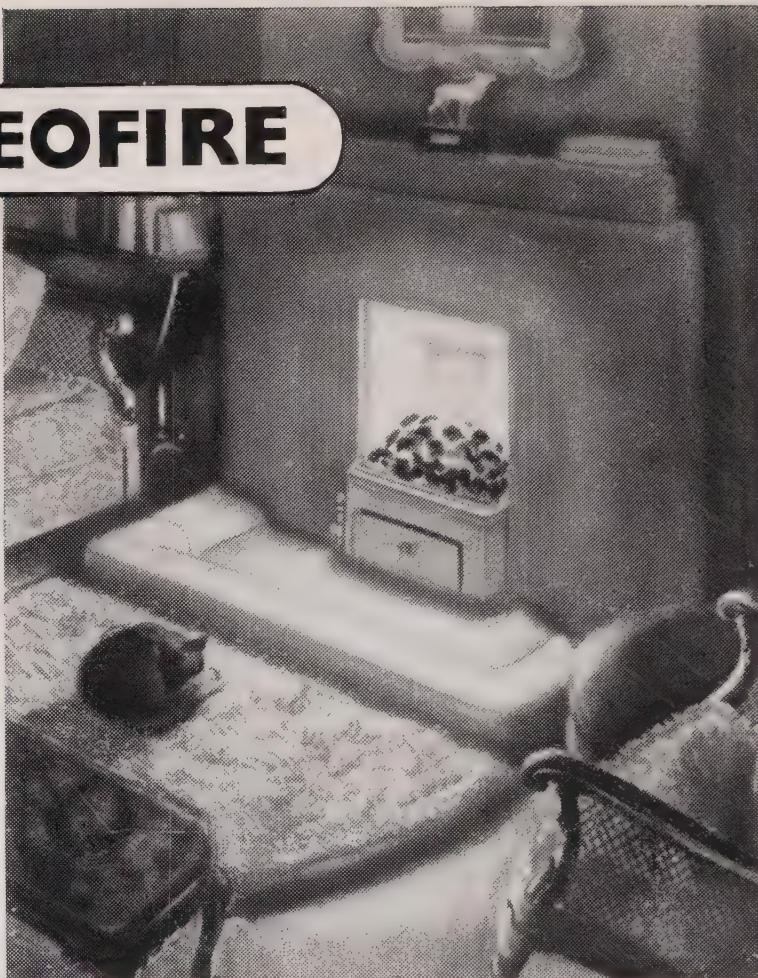
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SMOKELESS AIR

Vol. XXI. No. 75

Autumn, 1950

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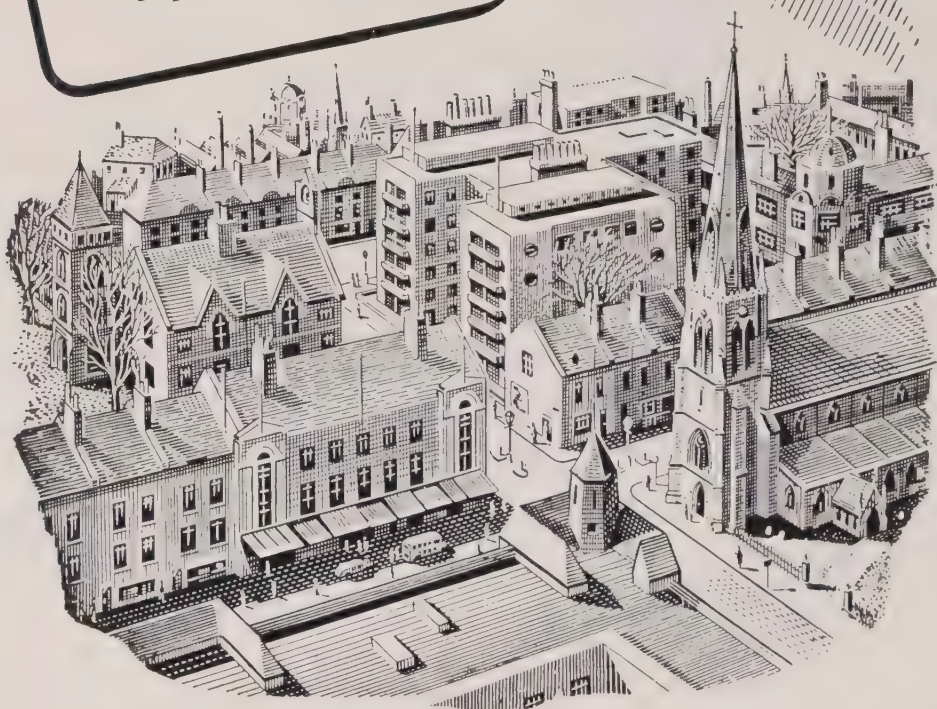
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

(See page 11)

SMOKELESS AIR

Antidote to Austerity

IT will be some time before the consequences of the new defence programme are fully experienced, but that it must mean a considerable return to austerity, and the further postponement of much urgently needed capital development cannot be doubted. The only way in which this painful progress can be mitigated is, as the Prime Minister has pointed out, by greater productivity. If, indeed, we could sufficiently improve the efficiency of production and eliminate the vast wastage of resources, materials and human effort that everywhere exists, we might even take the present rearmament diversion in our stride and still continue to improve the conditions of life.

Though this may be impractical, it is not impractical to point out that every step in the right direction means some lessening of the new burdens we are preparing to carry.

Obviously, in this journal, we are thinking of the cost and the waste involved in atmospheric pollution ; but we would go beyond this one example of inefficiency, important though it is, and suggest that public attention be directed more and more firmly to the need for fighting waste of every kind—not for the sake of fussy busybodies who like to see everything neat and tidy, but because it will mean, before very long, more goods in the shops, more new homes and schools, than will otherwise be possible.

The Chairman of the National Coal

Board, Lord Hyndley, has just spoken (as this is written) of the need for a big new drive in coal production to meet the calls of the new situation. More coal saving is equivalent to more coal production, and—to return to our own problem—less smoke production means more coal saved. The increasing momentum of progress towards smoke prevention that we have been working for during the past twenty-one years has been much more apparent of late, and must not be slowed down because of the harder conditions that are approaching ; on the contrary, it becomes more important than ever and justifiably demands more support and encouragement. Every item in the programme for smokeless air, from smokeless zones to the better training and status of stokers, means a contribution to the nation's economy by savings of fuel and by reducing the manifold injuries and unproductive diversion of man-power due to polluted air.

It would be foolish to try to claim too much for either this or any other single item in the list of national wastes and manifestations of inefficiency. It is, however, only by giving urgent and far more serious attention to every one of them that we can hope to find some sort of antidote to the new austerity.

The Sixth Division Council

At Birmingham, on July 4th, members and representatives in the West Midlands area met and agreed to set up what will be the sixth of the Society's Divisional Councils. In 1945, when the new constitution was adopted, membership was divided into nine geographical divisions, primarily for the purpose of ensuring that all parts of the country were fairly represented on the Executive Council. The constitution also allowed for the formation of Councils comprising all the members in each Division, and such Councils are now in being in all the Divisions except the South-West and the South-East. (The ninth Division, Northern Ireland, is virtually only an abstraction). There were former "Branches" in Scotland and the North-West, but the others,

Yorkshire, North-East, East-Midlands, and now West-Midlands, are all entirely new organisations.

All the Councils are an integral part of the Society. All members and the appointed representatives of corporate and local authority members are *ipso facto* members of their appropriate Divisional Council, without any further subscription. The expenses of the Councils—which must as yet be kept most modest—are met by annual grants from the national Society. The members of each Council elect their own Chairman, Hon. Secretary and Committee.

Divisional Councils and Regional Committees

In the areas of some of the Divisional Councils there is also one—or, in the North West, two—Regional Advisory Committees of local authorities. These are bodies which have been in existence since the 1920's or '30's. They meet periodically to discuss their common problems, perhaps engage in investigations, and otherwise act as advisory, joint consultative, discussion bodies. Most of the Committees, as well as most of their constituent members, are also members of the Society.

There has occasionally been some understandable confusion or doubt about the functions and constitution of the Society, its Divisional Councils and the Regional Committees. A few local authorities have not even found it possible to belong to both the Society and a Regional Committee (although the two subscriptions together would cost them less in a year than does smoke in half a day !).

There have also been one or two misgivings, which one representative voiced at the Birmingham meeting, about the desirability of a Divisional Council of the Society being set up in an area where a Regional Committee exists. On this two comments may be made : first, Divisional Councils have only been formed as a result of the wishes and action of members in the area, a majority of whom in every case have been local authorities ; and second,



A typical industrial town (Stoke-on-Trent) on a normal working day in winter. Compare this with the " smokeless air " picture on page 9 of the same town during the August holidays.

(Photos by E. J. D. Warrilow, Evening Sentinel, Hanley)

there is a very important distinction between the two organizations that must not be overlooked.

The Regional Committee are local authority committees exclusively, and as such have important functions connected with the work and responsibilities of local authorities—in improving and co-ordinating the administration of the law, co-operating in the measurement of atmospheric pollution, and so forth. The Society's Divisional Councils, on the other hand, include all interests concerned with smoke abatement: local authorities themselves, individuals, commercial firms, the fuel and power industries, and other voluntary associations. As with meetings of the national Society, they provide an open forum where all points of view may be expressed, and all interests may have their say. Without the Society and its Divisions a great deal of potential service for smoke abatement must

be lost. There is obviously a need for both the Regional Committees and for the Divisional Councils, and equally a need for them to work, as in fact they are doing, in friendly co-operation and understanding.

The Fuel Efficiency Exhibition

As we go to press over sixty firms have booked space at the forthcoming Manchester exhibition, an announcement of which appears on page 5. The local committee, convened by the Society's North West Division, is working hard and is arranging an excellent and full programme of organized visits, events and film shows. There will be special days, such as a "Stoker's Saturday," and perhaps similar days for other interests such as industrialists, technologists, local government officers, housewives. All the indications point to a full and very successful show.

“B.C.U.R.A.”

*An Account of the British Coal Utilization Research Association
and its Station at Leatherhead*

by

Dudley Evans

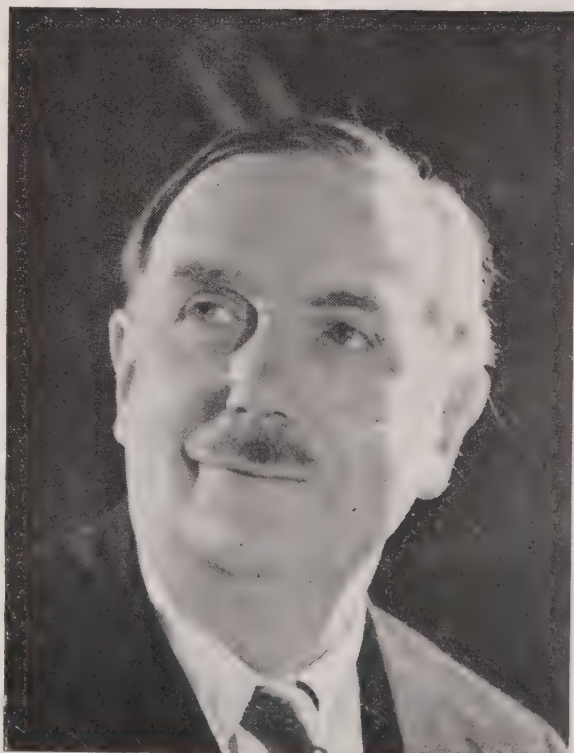
(Following our article on Watson House, a description of the B.C.U.R.A. station was being planned, in the course of which we were shown the following article, which had just been written by Mr. Evans for the special purpose of overseas distribution by the Central Office of Information. The interest of readers will be increased by knowing that it is being read, in many parts of the world and in many languages, as a telling account of an important British enterprise.—Ed.)

IT is economic commonsense that Britain, whose chief natural source of mineral wealth is coal, should aim at using the total output of her coal to the fullest advantage.

At the Experimental Station of the British Coal Utilization Research Association, the Director General, Dr. D. T. A. Townend, leads a highly skilled team of scientists in their search for the most efficient methods of burning Britain's coal. Far removed from the black background of the coalfields themselves, at Leatherhead, in the pastoral setting of the County of Surrey, Dr. Townend directs what is in effect a scientific world in prototype. In the B.C.U.R.A. workshops and laboratories, almost every faculty of science has at least one expert representative; from statisticians to chemists, from civil engineers to metrologists. Mr. J. B. Reed, Technical Information Officer at the Station explained to me that their aim is to use *all* types of coal efficiently, even the poorest grades; at the same time bearing in mind ways of burning bituminous coals smokelessly, to eliminate atmospheric pollution. “We are certainly concerned,” said Mr. Reed,

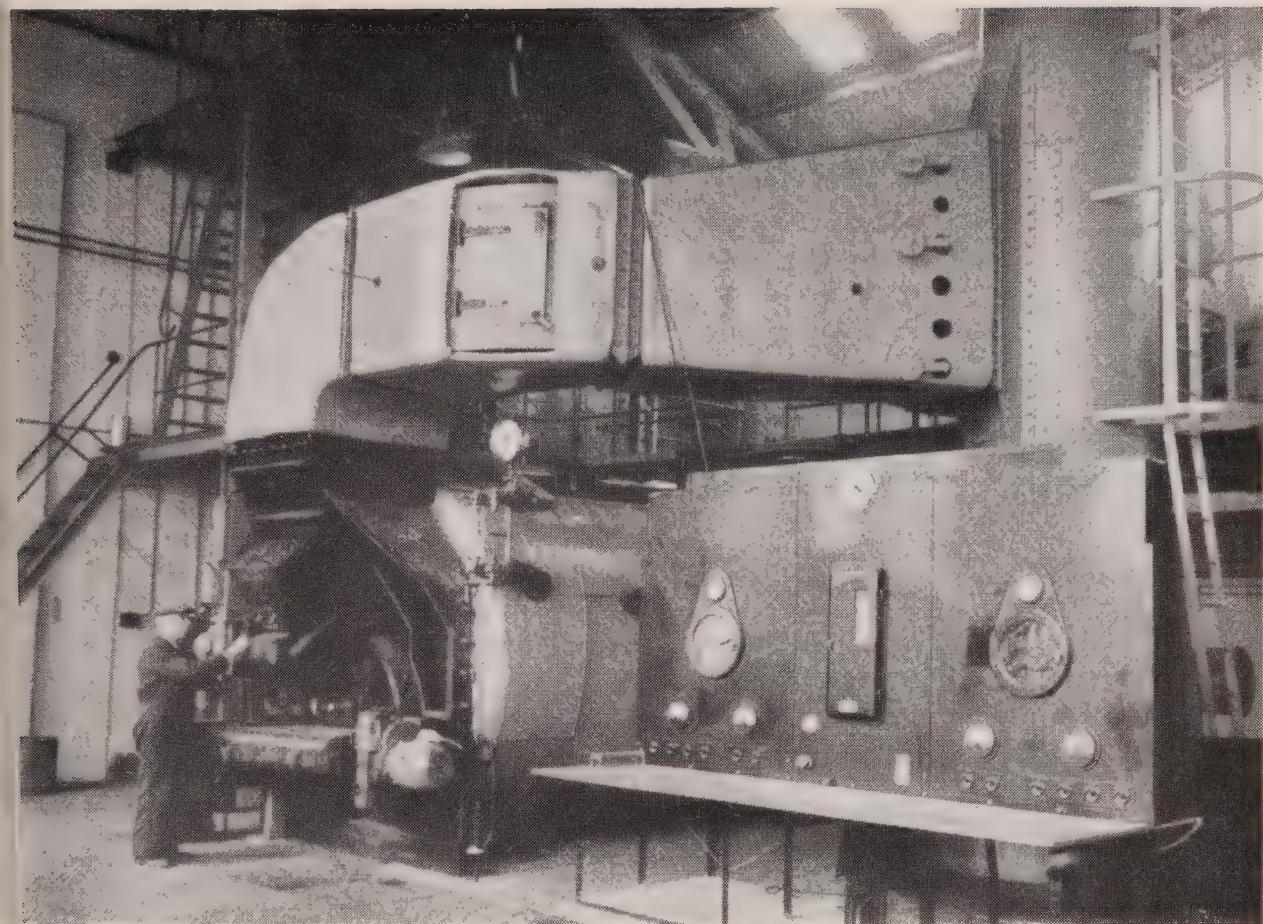
“with the good name of coal as a fuel.”

On our tour of the Station, we first called at the laboratories. Here, in the Laboratory Research Division, with true scientific humility, their first objective is “to extend the knowledge of the physical structure of coal” and “to correlate laboratory investigations of the composition and fundamental properties of coals”—in other words, to find out what coal is made of, where it comes from; its pore structure, its micellar linkage, its other properties. From these studies, 83 year old world-known authority, Dr. C. Seyler, has evolved a new technique of identifying



Sir Charles Ellis, F.R.S.

President of the Association.



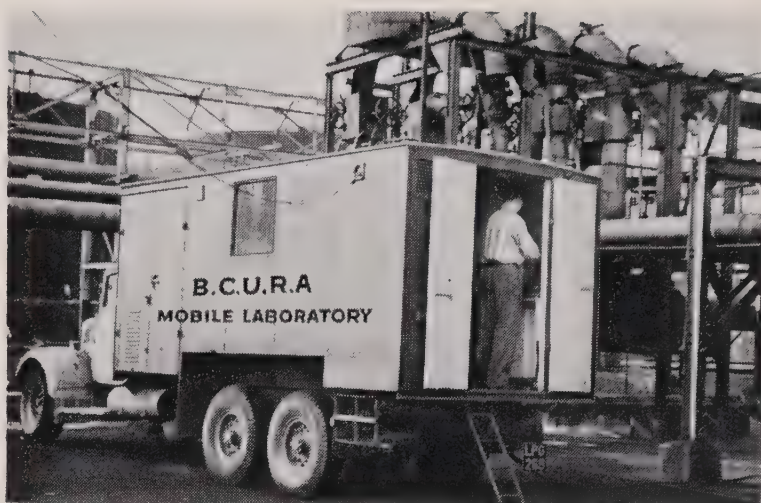
The experimental economic boiler in the Combustion Research Building.

coals from the manner in which they reflect light. By means of the Seyler Chart it is possible to establish the scientific relationship of coals, one to another, from all over the world. Amongst the fifty or more main lines of research in this Division are such items as the study of coal as a source of organic chemicals for industry; investigation of loss of inorganic constituents during combustion; obtaining information on structural materials resistant to high temperatures. B.C.U.R.A. has its own glass workshops, where specially trained glass-blowers provide the complicated apparatus required for the highly specialized work carried out in these laboratories.

Mr. Reed took me next to the Combustion Research Building, where engineers are working at a fully-instrumented test unit to increase the efficiency of shell-type boilers. The better use of coal in this type of boiler is vital to British industry, which is used

so extensively as to consume some 80 million tons of fuel per year. B.C.U.R.A. studies already show that the effect of *excess* air in shell-type boilers is more likely to reduce performance than was previously supposed and that precise control of moisture content in fuel can increase efficiency. In a short time, B.C.U.R.A. hopes to get a complete picture of the relative steam-raising capacity of British coals.

Valuable work is going ahead to reduce, and eventually eliminate, the corrosion on the heating surfaces of water-tube boilers. Of prime concern to electricity-generating power stations, who are the largest users of this type of boiler, research has indicated that the addition of suitable "dust" in right quantities to the combustion gases acts as a palliative. An essential part of the work is the development and improvement of instruments for the measurement of gas temperatures, condensation characteristics, and the rest of this skilled analytical research.



At work on a field test.

In the Plant Division, the B.C.U.R.A. experts have brought to light hitherto unknown facts about the combustion of solid fuels. British-invented, patented and developed, the "Down-Jet" Principle of Combustion feeds air *down* on the the fuel bed, which is supported on a solid hearth. Very high temperatures can be obtained and there are no metal grate-bars which would burn under intense heat. A large amount of heat is generated in a small space; low-grade fuels can be burnt; combustion is smokeless; con-

struction of the apparatus is simple; ash extraction can be almost automatic. This "Down-Jet" method of combustion is no one-man discovery; it is one of the results of the work of what Dr. Townend calls his "complete team of scientists." In the Leatherhead experimental plant, research is now being made on the design of a combustion chamber suitable for burning pulverized low-grade fuel for gas-turbine propulsion.

Further important results may be expected from this experimental work.

Another Division is concerned with the improvement of domestic appliances using coal. British tradition still demands the open fire, but B.C.U.R.A. has designed more efficient household grates, to give better heat and ventilation while consuming less fuel. A complete housing unit has been designed, pre-fabricated and factory-made, around which a new house can be built, giving all the services of heating, cooking, hot and cold water, ventilation,



Tests in progress on the measurement of smoke passing up the flue.

plumbing and electric installation.

Dr. Townend explained that B.C.U.R.A. is the second largest of some forty-three Research Associations in Britain, all partly Government supported; there are, of course, in addition many research organizations wholly supported by the Government. B.C.U.R.A. is an autonomous Limited Company, sustained by industrial members and with a "topping-up" grant from the Government proportional to its income from membership. Since

nationalization its largest member has been the National Coal Board, but other members range from the British Electricity Authority and Imperial Chemical Industries, to the small manufacturer of domestic appliances and the coal distributor. B.C.U.R.A. is unique; it is a Forum where private firms and nationalized industries deliberate together for the greater efficiency of using coal throughout the whole of industry, and thus for the advancement of national prosperity.

J. R. Ashworth

It is with regret that we record the death, at his home in Rochdale, on July 8th, of Dr. James Reginald Ashworth, for many years a most active member of the Executive Committee of the Society. Dr. Ashworth, who had reached the age of 89, was formerly a science teacher in Rochdale. He carried out much experimental work in meteorology, magnetism, and especially on the behaviour and effects of pollution in the atmosphere and on the measurement of daylight and ultraviolet radiation, comparing smoky with clean areas. He contributed a number of papers to *Nature* and other journals, published a book and several monographs, and devised new instruments and a light-measuring meter.

He had been curator of the Manchester Literary and Philosophical Society since 1929, and until recently was honorary secretary of the Rochdale Literary and Philosophical Society—an office he had taken over from his brother in 1885.

Dr. Ashworth did much to help the Society in its earlier days, and before that the Smoke Abatement League of Great Britain. His practical work on the measurement and analysis of pollution did much to stimulate other similar work and to bring home to the authorities and the public alike the full extent of the consequences of smoke. Since so much of his published results related to Rochdale he was unwittingly

responsible for that town being sometimes regarded, obviously unfairly, as one usually afflicted by smoke: a matter that was sometimes resented by Rochdaliens who had in fact every reason to be proud of so distinguished a citizen.

A. L. Holton

We also regret to record the recent death of Mr. Alfred L. Holton, at the age of 74, at his home in Hale, Cheshire. Mr. Holton was chief engineer of the Manchester Gas Department until his retirement in 1940. He had been with the department for 48 years, and had been honoured three times by the Institution of Gas Engineers. For a number of years, up to the last war, he was a member of the Executive Committee and a good and helpful friend of the Society, whose appreciation of its work stimulated the interest of many of his colleagues in the Gas Industry.

Alexander Munro

As we go to press we regret also to learn of the death, on 22nd August, of Alexander Munro, who until his retirement in 1947 had been a member of the Glasgow City Council for 27 years. He had been a prominent member of the Society's Scottish Division and was for many years a member of the National Executive Committee, and regularly attended the annual conferences, where he was always a forthright spokesman for Scotland.

THE UNITED STATES TECHNICAL CONFERENCE

A First Report

AS noted in our last issue, the big U.S. Conference, arranged on the proposal of President Truman, took place in Washington on May 3rd to 5th. It was attended by nearly 700 representatives from all parts of the country—scientists, lawyers, engineers, industrial executives and government officials. Delegates from the British Government were Dr. A. Parker, Director of the Fuel Research Station, and Mr. W. A. Damon, Chief Inspector of Alkali, etc., Works of the Ministry of Health, both of whom contributed papers. Dr. Lessing, Chairman of the Society's Technical Committee, attended in a private capacity.

The President sounded the keynote of the meeting in a welcoming statement stressing the seriousness of the problem, but at the same time emphasizing that it was a local rather than a federal problem. The federal government, he said, should take the leadership, but only in the overall research work; control laws must be adapted to local conditions and this could only be done locally.

After a full opening meeting, the conference divided into seven panel discussion groups which met simultaneously, with a concluding overall session on the closing day. At the end—described in one press report as the chief product of the meeting—a resolution was passed recommending that the government set up an advisory council on air pollution. The chief function of this council, it was said, was the development of a programme which had for its object the "solution of all air pollution problems in the most effective and expeditious manner."

The seven panels were concerned with the following subjects: health, meteorology, instrumentation, equipment, analytical methods, legislation,

and agriculture. It is unfortunately impossible to devote space in our limited number of pages to a complete set of the abstracts of these papers, but a list of the titles of the papers and their authors in each panel is given below. Abstracts of those marked with an asterisk have been received, and we shall be pleased to supply typescript copies of any of these to any readers who would like to have them. (It will be noted that we have not yet received any of the abstracts on the papers in the Health panel.)

Later, it may be possible to quote from or discuss some of the actual papers, as it is understood that the proceedings of the conference are to be printed and published in book form. It will be an important addition to the literature on the subject.

PAPERS READ AT THE CONFERENCE

Agriculture Panel

Some Impurities in the Air and their Effects on Plants, *M. D. Thomas*,

Similarities between Disease Symptoms and Chemically Induced Injury on Plants, *L. M. Massey*.*

Effects on Livestock of Air Contamination caused by Fluoride Fumes, *W. T. Huffman*.

The Effects of Air-Borne Fluorides on Livestock, *Edward J. Largent*.*

The Effect of Sulphur Dioxide on Conifers, *Morris Katz* and *A. W. McCallum*.*

Effects of Fluorine Fumes on Vegetation, *Burton B. Bayles*.

The Effect of Fluorine on Plants as determined by Soil Nutrition and Fumigation Studies, *Robert H. Daines*.

2, 4-D as an Air Pollutant and its Effects on Various Species of Plants, *Author not named*.

Industrial Gases in Relation to

Agriculture with Special Reference to Hydrofluoric Acid Gas, *V. L. Miller.**

Various Impurities in the Air and their Effect on Plants, *P. W. Zimmerman.**

Plant Absorption of Materials Contained in Air Versus Soil, *Walter H. MacIntire.**

The Atmospheric Pollution Problem of Mine Refuse Piles, *P. W. Zimmerman.*

Analytical Methods and Properties Panel

Fluorometric Analysis, *Charles E. White.**

Chemical Analysis of Air Pollutants, *A. J. Haagen-Smit.**

The Spectrum of Particle Size and its Relation to Air Pollution, *Hamnet P. Munger.**

The Use and Limitations of the Midget Impinger for the Evaluation of Aerosols, *H. B. Charmbury.**

Measurement of Concentrations and Characteristics of Atmospheric Contaminants, *Victor K. LaMer.**

Methods for the Differentiation of Sulphur-Bearing Components of Air Contaminants, *Morris B. Jacobs.**

An Investigation of a New Colorimetric Reaction: a Suggested Outline for Research, *John H. Yoe.**

Properties and Behaviour of Air Pollutants, *H. F. Johnstone.**

Spectrometric Analysis: Application to Atmospheric Pollutants, *R. A. Friedel.**

Application of the Mass Spectrometer to Air Pollution, *Martin Shepherd.*

Application of the Infra-red Spectrometer to Air Pollution, *Carroll Creitz.*

Spectrographic Analysis in Air Pollution Studies, *B. F. Scribner.*

Application of the Electron Microscope to Air Pollution, *Howard McMurdie.*

Microscopical Recognition of Particulate Pollutants, *Charles Proffer Saylor.*

Infrared Spectroscopy, *Van Zandt Williams.*

Optical and Mechanical Properties of Aerosols, *David Sinclair.**

Equipment Panel

Properties of Aerosols as Related to Air Cleaning, *W. H. Rodebush.**

Properties, Physiology, and Psychology of Odor, *Carey P. McCord.*

Odor Control Practices, *William H. Witheridge.**

Dry Fibrous Filters, *Walter Smith.**

Viscous Impingement Filters, *James May.**

Bag Filters, *Robert T. Pring.*

Filter Beds, *Leslie Silverman.**

Principles of Design, Application and Performance of Dry Inertial and Motor Powdered Dynamic Separation, *Joseph M. Dalla Valle.**

Spray Towers, Bubble Towers and Packed Towers Using Reactive and Non-Reactive Liquids, *J. Louis York.**

Pease-Anthony Spray Towers and Venturi Scrubbers, *R. V. Kleinschmidt and A. W. Anthony, Jr.**

Condensation Chambers and Techniques, *John Yellott.*

Fundamentals of Equipment Design and Practical Uses of Solid Sorbents for the Control of Atmospheric Contamination, *R. B. Ray.*

Fundamental Principles, Design, Applications, Performance and Limitations of Electrical Precipitation Equipment, *Walter Schmidt.*

Theory and Basic Principles of Sonic Type Flocculators and Collectors, *Hillary S. St. Clair.*

Design, Application, Performance and Limitations of Sonic Type Flocculators and Collectors, *Ernest P. Neuman.*

Use, Performance and Limitations of Short Stacks and Chimneys in Congested and Non-Congested Building Areas, *G. S. McElroy.*

Some Fundamental Considerations in the Design and Use of Incinerators in the Control of Atmospheric Contamination, *Richard C. Corey.**

Railroad Activity in Reducing Atmospheric Pollution, *Earle C. Payne.*

Design and Use of Smokeless Hand Fired Residential Coal Burning Equipment, *James R. Gorrey.**

Smoke and Dust Abatement from Small Industrial Heating Plants, *William S. Major.*

Power Plant Design, Equipment and Operation, *Author not named.*

Health Panel

Short Range Exposure to High Concentrations by Air Pollutants, *J. G. Townsend.*

Acute Effects of Air Pollution in Donora, Pennsylvania, *William F. Ashe.*

Skin Effects of Air Pollutants, *Marion Sulzberger.*

Chemically Active Air Pollutants, *I. R. Tabershaw.*

Effects of Exposure to Air Pollutants, *Robert A. Kehoe.*

Cancer in Air Pollution, *W. C. Hueper.*

Effect of "Inert" Dusts in Air Pollution, *Arthur J. Vorwald.*

Effects of Ionizing Radiation for Air Pollution, *Abel Wolman.*

Effects of Fog, *L. P. Herrington.*

Effect of Loss of Sunlight, *Harold F. Blum.*

Effects on Oral Structures from Air Pollution, *James M. Dunning.*

Effect of Chronic Exposure of Air Pollutants on Acute Infectious Respiratory Diseases, *Anna Baetjer.*

Instrumentation Panel

Atmospheric Sampling by Electrostatic Precipitation, *E. C. Barnes.**

New Developments in Instrumentation for Air Pollution Studies, *Clede Brunetti.**

Sonic Method of Determining Particle Size, *Hans M. Cassel.**

The Direct Photography by Dark Field Illumination of Particles in Aerosol Suspensions, *Albert L. Chaney.**

A Recording Visibility Meter, *A. L. Chaney.*

Instrumentation Methods of Measuring Mass Concentration and Particulate Concentration in Aerosols, *F. T. Gucker, Jr.**

The Photoelectric Determination of Atmospheric Sulphur Dioxide by Dilute Starch-Iodine Solutions, *Morris Katz.**

Aerosol Detection and Measurement, *Victor K. LaMer.**

The Modified Cascade Impactor, *Sidney Laskin.**

Instruments Used for Measuring Atmospheric Pollution in Great Britain, *A. Parker and S. H. Richards.**

Problems in the Recording of Sulphur Dioxide Polluted Atmospheres, *George*

*A. Perley and B. F. T. Langsdorf.**

Instrument for Automatically Determining Particle Size, *R. L. Pigford.**

Automatic Apparatus for the Determination of Small Concentrations of Sulphur Dioxide and other Contaminants, *M. D. Thomas and J. O. Ivie.**

New Developments in Instrumentation, *Arnold O. Beckman.*

The Continuous Measurement of Sulphur Dioxide and Hydrogen Sulphide Concentrations by Automatic Titration, *Harold W. Washburn and Robert R. Austin.**

Legislation Panel

The Pittsburgh Air Pollution Ordinance, *Anne X. Alpern.*

The California Air Pollution Act, *Harold W. Kennedy.**

The Operation of a Hearing Board, *Harbert V. Walker.**

The St. Louis Smoke Abatement Ordinance, *R. R. Tucker.*

Industrial Considerations of Air Pollution Regulations, *Richard F. Hansen.**

Problems in the Drafting and Administration of Air Pollution Control Legislation, *Arthur C. Stern.**

National Aspects of Atmospheric Pollution Legislation, *John L. Hofflund.*

Legal Aspects of Atmospheric Pollution and Methods of Control Used in Great Britain, *W. A. Damon.*

Meteorology Panel

Meteorological Aspects of Atmospheric Pollution, *E. Wendell Hewson.**

Review of Recent British Research Work on Diffusion in the Lower Layers of the Atmosphere, *K. L. Calder.*

Diffusion of Hot Smokes from Chimneys, *O. G. Sutton.*

Stack Meteorology as Related to Power Plants, *Ward F. Davidson.**

Air Pollution and Fog Properties, *H. Neuberger.**

The Micrometeorological Installation of the University of Washington, *Phil E. Church.**

The Diffusion Problem in Hilly Terrain, *Joshua Z. Holland.**

The Application of Meteorological Control to Atmospheric Pollution Problems, *Maynard E. Smith.**



Power from the Wind

Its Possible Contribution to Electricity Supply

WESTERN civilization depends on a plentiful supply of artificial heat, and since its emergence in Greece 2,500 years ago, until recent times, heat has been obtained by burning various fuels—wood, peat, coal, oil, etc. At first the heat requirements were modest—for cooking and to maintain a reasonable degree of comfort during the winter in domestic premises, and for a few industries serving domestic needs, such as iron, glass, pottery, etc.

The industrial revolution increased the demands for artificial heat and in this country this was provided by the consumption of coal which was plentiful and cheap—in fact, so cheap that few cared to take the trouble to burn it efficiently, with the result that a large proportion of the coal consumed went into the atmosphere in the form of the smoke and tar which has defaced the

buildings of so many of our towns. In recent years, particularly in countries in which coal was not so plentiful, increasing supplies of energy have been obtained from hydro-electric power, which in this country is beginning to make an appreciable contribution.

With the growing realization that the world's supplies of fuel are not inexhaustible, greater attention has been directed to the development of alternative sources of energy, in addition to hydro-electric power and atomic energy which is giving rise to so much discussion at the present time.

At the Fourth World Power Conference in London this year, many alternative sources of power were suggested; the heat pump for raising low-grade heat to levels at which it can provide a useful source of energy, heat from volcanic sources, the operation of

heat engines on the temperature difference of 68°F., between the surface of the tropical sea and at a depth of 1,640 ft., and also the generation of electricity by power obtained from the wind.

Power from wind is of course very old, as the windmills, most of them derelict, scattered over the countryside bear witness. It has also been used extensively for pumping and more recently on isolated houses and farms for generating electricity for charging batteries. These electricity generating plants were usually small, and what is now under consideration is on a much larger scale intended to take a part in the general electricity supply system of the country.

The importance of alternative sources of power in the electricity supply of Great Britain will be appreciated from the estimate that has been made that at the present rate of increase, the annual coal requirements of the electricity supply service will amount in 1970 to at least 75 million tons, to provide which would require a vast increase in coal output from our mines, or a drastic reduction in the coal used for domestic and industrial purposes. Abroad also, this problem of providing sources of energy is of vital importance and several attempts to generate electricity from wind power on a considerable scale have already been made. In Denmark there are some 90 plants driving generators of from 20 to 70 kw. connected to local network in association with oil-driven plants—a typical plant is shown in the accompanying illustration. In the Crimea a 100 kw. plant was erected in the early thirties and is believed to have worked successfully until it was destroyed by the German Army. On a larger scale a 1,250 kw. generator was erected some years ago in Vermont, U.S.A., which operated in conjunction with the public supply for several years until it failed by the loss of one of its blades.

The Northern coasts of Scotland are known to be some of the windiest in the world, and with a view to ascertaining the possibility of reinforcing the public

electricity supply by power generated by the wind, researches carried out jointly by the Electrical Research Association, the Air Ministry Meteorological Office and the North of Scotland Hydro-Electric Board have shown that on certain sites the conformation of the ground accentuates the wind velocity very considerably. As a result of these experiments, it has been decided to instal an experimental plant consisting of a 100 kw. wind-driven generator at Costa Head on Mainland.

The choice of Orkney for these experiments is very appropriate. At present the main source of power is the diesel-engine driven plant in Kirkwall, and the North of Scotland Board is erecting a new plant and a 11 kv. distribution circuit around the island. Any power generated by wind, estimated to be likely to amount to 400,000 units a year, will save an amount of diesel oil, with its freight charges a very expensive fuel. Moreover, on island sites such as this, with a small catchment area, there is unlikely to be any large amount of water available for hydro-electric power.

The experimental 100 kw. generator is being constructed by Messrs. John Brown and Co., and the accompanying



Artist's impression of projected windmill at Costa Head.

illustration gives an impression of its probable appearance. It will be situated some 20 miles from Kirkwall and will feed into the distribution network. Its capacity will be below the minimum summer night load so that it should be able to operate continuously. The frequency, and consequently the speed of the wind vanes, will be controlled from the power station.

The British Electricity Authority announced in its first annual report that another 100 kw. plant was to be erected on the Cornish coast near Hayle to assist in the general survey of wind potential.

The erection of these plants will afford an opportunity to ascertain the reliability and efficiency of wind driven generators, give some indication of the cost of power so generated, and afford some indication of the optimum size of plant to be constructed. In so far as it has been possible to arrive at any costing figures, the outlay would appear to be of the order of £50 per kilowatt and it is estimated that the annual output would be of the order of 3,500 to 4,500 kilowatt-hours per annum for each kilowatt of plant installed. It is estimated that operating costs, including maintenance, would amount to some 8 per cent. of the capital cost, which would put the cost of power at about one farthing a unit.



Modern Danish windmill, rated at 70 kw.

The results of the experiment will be watched with interest. It will be realized, however, that even when a reliable generator has been produced, it will be some time before wind power can make a serious contribution to the electricity supply, or in the reduction of smoke in the atmosphere.

The Society Comes of Age

The articles and greetings that appeared in our last two issues on the Society's 21st Birthday are being reprinted, with extra illustrations and an attractive coloured cover, as a 20-page brochure that will not only be a record of the occasion but a useful and pleasant means for introducing the Society to potential new members. We shall be glad to send a copy to any member who would like to have one, or to any persons whose names and addresses are given us. Better still, since the personal approach is often the best way of obtaining new members, we shall be glad to send to all members who can help in this way, copies of the coming-of-age brochure with other booklets and information, all packed in a suitable envelope for posting.

Copies of *The Society Comes of Age* can also be sent to local authorities and corporate members for distribution among their committees, Councils, etc. Please write for details.

Smoke Signals

An Article from "Fuel Efficiency News"

"Fuel Efficiency News" is a monthly broadsheet published by the Fuel Efficiency Branch of the Ministry of Fuel and Power. In addition to notes, news and short practical articles, there are frequent references to smoke prevention as a factor in fuel efficiency and examples of how action to reduce smoke has led to fuel savings. "Fuel Efficiency News" is now obtainable at a subscription of 3s. a year through H.M. Stationery Office. The following editorial is reproduced, by kind permission, from the June, 1950, issue.

THE story is told that, when the first atom bomb was exploded in the New Mexico desert, an Indian who was sending smoke-signals watched the great mushroom of smoke rise, and remarked, "I wish I'd said that; it's really significant."

Smoke from industrial chimneys also tells a significant story, for it so happens that smoke abatement and fuel efficiency go hand in hand most of the way. In 1945, Dr. Dobson, Chairman of the Atmospheric Pollution Research Committee stated, that, as a result of the first year's work of the fuel efficiency campaign, there was a reduction in pollution of 11 per cent. throughout the country. The almost automatic plea that inferior fuel is responsible for excessive smoke is insupportable, but it is, nevertheless, likely to be used for some time to come as an excuse for inefficiency.

Combustion process

Let us follow what happens when fresh coal is thrown upon a hot fire. It is heated by the coal already burning on the firebed, bursts into flame and, in turn, also generates heat. A chemical reaction takes place in which oxygen from the air combines with the carbon in the coal. The necessary air reaches the coal from below the grate, through the firebars, and is known as *primary* air. To complete combustion, air

known as *secondary* air has also to be admitted over the top of the fire.

Action of secondary air

When there is ample primary air to complete combustion, carbon and oxygen combine to form non-inflammable carbon dioxide (CO_2). As this gas passes through the incandescent firebed, it meets further hot carbon particles and is broken down to form another gas, carbon monoxide (CO). Carbon monoxide, if mixed with air at ignition temperature, will burn. Considerable heat will be liberated and the gas will be converted to carbon dioxide. The provision of secondary air is therefore useful in this way but it is also required for burning the tarry gases driven off when fresh coal is added to the fire-bed. These gases, composed mainly of hydrogen and carbon, are known as the *volatiles*. If there is insufficient secondary air present, these volatiles escape unburnt in the form of smoke and fuel is wasted.

It is illogical to complain that poor efficiency results from low quality fuel while at the same time allowing the emission of combustible smoke. To avoid this loss, all that is necessary is to admit more secondary air for a few minutes immediately after firing fresh coal. As soon as the volatiles have been burned, the secondary air supply should be reduced to prevent waste.

Control of air

By controlling the amount of air reaching the coal, the rate at which it is burned can be regulated. Natural draught is created by a chimney, and air circulation through the furnace of a boiler system is produced by using some of the heat of the fire. Dampers enable the air supply to be controlled and, thus, the rate of burning, of heat liberation and of steam generation. Care requires to be taken, however, to avoid the

cooling effect of air passing through bare spaces in the grate where holes have been left in the firebed. This air plays no part in combustion and is, in fact, one of the worst heat-thieves. A level fire-bed should therefore always be maintained and any holes which may appear should be filled when firing fresh coal.

The correct amount of air to apply can be judged by reading the CO₂ meter, which measures the percentage of carbon dioxide in the flue gases. When burning coal 12-14 per cent. CO₂ indicates a high combustion efficiency. Too much air produces a low carbon dioxide reading and a high heat loss to the chimney. Too little air produces carbon monoxide, smoke and heat loss from incomplete combustion of fuel. The correct draught is that which carries the load and produces the maximum percentage of carbon dioxide in the flue gas without smoke or carbon monoxide.

Sources of improvement

The chief way of reducing smoke is by improvements in firing practice. Fuel Engineering Assistants of the Ministry of Fuel and Power are prepared to visit any combustion plant and give practical demonstrations on the firing floor.

As a long-term project, boilerhouse practice courses are available to give sound training in this work. Many men engaged in boilerhouse work have already benefited from these courses and the general standard of performance would undoubtedly be raised if more could be encouraged to follow their example.

Home fires

There are now far greater opportunities than ever before of avoiding smoke emission from domestic chimneys. Improved solid-fuel burning appliances, which satisfy minimum standards formulated by the Ministry of Fuel and Power, are now easily procurable and are being installed in new local authority houses. These improved appliances are all capable of burning one or more

smokeless fuels efficiently. Those which also burn bituminous coal have greater combustion efficiency than older types and so aid diminution of smoke. The Coal Utilisation Joint Council, of 13 Grosvenor Gardens, London, S.W.1., issues a list of recommended appliances for all types of houses, and in this list appliances suitable for low-cost housing are appropriately marked.

Stacks and money

At a certain office building in the City of London, the old hands took pleasure in explaining to newcomers that smoke emerging from the Bank of England chimneys on Thursdays was caused by the burning of currency notes withdrawn from circulation. Whether this were true or not, the newcomer always had a feeling of regretful awe at the thought of real money going up in smoke. It is more common than he knew. Is your chimney-stack a means of converting money to smoke?

The following news items are also culled from the same issue of "*Fuel Efficiency News*":—

"A complaint was received in the Midlands of excessive smoke emission by a plating company using 6 tons of coal per week. After instruction had been given in firing, cleaning and damper control, the pump was regulated to give constant feed, and coke substituted for graded coal. Consumption with the same load decreased to 2½ tons of coke per week."

"Owing to narrow boiler flues, a brewery in Yorkshire emitted excessive smoke and was unable to maintain steam pressure on the small hand-fired natural-draught Lancashire boiler which used 11 tons of coal per week. The flue was enlarged, a larger damper was fitted at the chimney base, and instruction was given on the best method of firing. As a result, not only were the difficulties overcome, but a saving estimated at 1 ton of coal per week was made. It is expected that the installation of fan forced draught and mechanical stokers will produce further savings."

THE 1949 REPORT ON ALKALI, &c., WORKS

86th Annual Report on Alkali, etc., Works, by the Chief Inspectors. Proceedings for the Year, 1949. (H.M.S.O., 1950, 1s. net).

The new report contains many references that will be of interest to readers of this journal. The problem of burning spoilbanks is again considered in some detail and special attention is drawn to the question of fires which break out from abandoned spoilbanks. These fires are often smouldering below the surface and give little indication of nuisance by emission of smoke or fume. "Owing to the past undesirable practice of indiscriminate tipping it has been difficult to determine the extent of the tips or their depths at any particular point," says the report. "In many instances they have become grassed over and resemble natural ground. Houses have been built close to them and even roads built over them. The position is further complicated by the question of ownership and the difficulty of deciding who has legal responsibility for the expenses of dealing with the fires."

The case is cited of a child, playing on a spoilbank, who was burned to death when a small section of the crust gave way and he fell into a hot cavity. "Both this and other sections of the spoilbank were cold on the surface and largely grown over with grass. There was no indication of fire or reason to suspect that it was supporting internal combustion," states the report. "This sad occurrence shows the difficulty of determining when combustion has really ceased and has been advanced as an argument for levelling and consolidation of all abandoned spoilbanks, as soon as circumstances permit."

In another case a shallow outcrop of coal became ignited causing fissures and fumes in nearby gardens and a fear that houses might be affected.

By combining water spraying to

inhibit combustion in freshly tipped refuse and spreading and levelling to consolidate the older material, there is a prospect of disposal of refuse in a safe and not too obtrusive manner.

The report also discloses that research is now in hand to determine the effect at ground level of discharges of sulphur dioxide from high chimneys and to investigate cheaper and more practicable methods of elimination than those at present in use. Experiments have also been carried out to reduce drizzle from water cooling towers about which there has been much complaint.

The number of works registered under the Alkali, etc., Works Regulation Act, 1906 was 969 in 1949, involving the operation of 1,741 separate processes. Compared with 1948 this shows a reduction of 14 works and 25 processes. This reduction relates mainly to by-products of the coal carbonisation industry and follows the trend which has been apparent for several years.

During the year alkali inspectors paid 3,752 visits, including 378 to or in connection with works not registered under the Alkali Act, and a further 200 to, or in connection with, spoilbanks. During the inspections, 2,198 quantitative analyses were made of gases escaping to the atmosphere from the processes in operation. A total of 87 infractions against the provisions of the Act were recorded. In no case was it necessary to institute legal proceedings.

The Chief Alkali Inspector for Scotland reported that he had made 217 visits to registered works and carried out 119 chemical tests of fumes emanating from the works. In addition he made 175 visits to unregistered works. He comments: "The general standard of maintenance continued to improve during the year and more of the leeway in major repairs due to the war was overcome."

Smoke on Tees-Side

From a Paper by A. H. Rushworth,
Senior Sanitary Inspector, Billingham U.D.C.

We record the main part of a Paper read at the Annual Meeting of the North East Divisional Council of the Society, at Middlesbrough, on June 6th, 1950.

IT is generally understood that atmospheric pollution is divided into two main categories: (1) industry, and (2) domestic sources, each contributing approximately 50 per cent of the total nuisance. This may be so taking the country as a whole, but I am doubtful as to the accuracy of the statement in industrial areas, and I am perfectly certain that it does not apply in my own district, where one firm alone, namely Imperial Chemical Industries, Ltd., consumes approximately 3,000 tons of coal a day, the boiler plant, operating on pulverized coal, taking 2,000 tons of this. The present dedusting equipment on the boiler plant consists of a wet washing arrangement plus a system of sprays. This apparatus is estimated to give an efficiency of about 96 per cent, but it will readily be appreciated that the remaining 4 per cent of dust and grit can and does constitute a very substantial nuisance. In fact, in one deposit gauge, placed about a quarter of a mile from this boiler plant, a total of 1,896 tons per square mile was recorded last year. For the same year, a gauge sited north of Billingham station in a residential area recorded a figure of 108 tons.

In round figures this means that the industrial area had a deposit approximately 18 times greater than the residential area. A gauge in the Council Offices grounds recorded a figure of 1,127 tons, and a lead peroxide instrument in the same situation gave an average daily reading of 76.41 mgms. per 1,000 sq. cm. This high acid record is, no doubt, partly caused by an adjoining sulphuric acid plant which continuously pours out heavy white

fumes, which, under certain weather conditions, quickly come to ground, and with a south-west wind, envelop the adjoining property causing a very serious nuisance. In fact, the sum total of emissions in this particular area at times makes life almost unbearable and, in my opinion, human beings should not have to live in such a polluted atmosphere. Just before the war a large number of these fine houses were standing empty as people who could either rent or buy a house in more congenial surroundings, simply refused to live under these conditions.

This afternoon, you will have an opportunity of seeing this area although weather conditions may be favourable causing emissions to disperse more effectively, but conditions on a dull, heavy, foggy day, with a saturated atmosphere and little or no wind, can better be imagined than described. During November, 1948, when a considerable period of weather of this description was experienced, a deposit of 450 tons per square mile was recorded.

Helpful Co-operation

What I have said would appear to cast very serious reflections on I.C.I., but yet another reason for giving this talk is to take the opportunity of stating publicly that my Council as an official body, and myself as a public official, have experienced nothing but the utmost help, co-operation and kind consideration from the Directors and Officials of this concern. During the past twenty years we have had many joint conferences and always we have been received with courtesy, goodwill and a readiness to discuss ways and means to remedy the various emissions which emanate from this tremendous factory. Perhaps people living in the affected area may be excused for doubting the sincerity of the firm in their

efforts but if the amount of time and money which has been, and still is, being spent on remedial measures were generally known, I think more credit would be given for the very great efforts made. As the official concerned with these matters I can say that in most cases a very high degree of efficiency has been achieved with equipment designed to obviate or reduce specific emissions and it is only because of the size of the problem and the close proximity of dwelling houses, that it would appear that a stage has been reached when little further improvement can be expected.

You may be thinking that Billingham urban district is a most undesirable place in which to live and quite frankly, another reason for giving this talk is to take the opportunity of refuting any such idea. For many years my Council have had the courage and public spiritedness to speak very forcibly in Council about atmospheric pollution and no doubt newspaper headlines have helped to give the impression to which I have just referred. As an example: quite recently a Councillor from an adjoining district made the uncharitable statement that Billingham is under a constant pall of smoke. This view is held too commonly by people not acquainted with the true position. In fact, people on visiting the area for the first time have expressed surprise on finding something quite different from preconceived ideas. Allowing for an understandable prejudice, let me say here and now that Billingham is a fine place and after visiting the blighted area, you will be shown other parts of the district from which you will be able to draw your own conclusions. It should be clearly and definitely stated that Billingham is a modern and progressive community, developing on sound lines with most amenities available for a happy and healthy life. It should also be clearly and definitely stated that it is only in the Haverton Hill area that atmospheric pollution is a serious nuisance. These facts should be given the widest publicity.

At this point I would like to say a

word about Middlesbrough and, in doing so, I cannot be accused of being interested otherwise than in a friendly way. For some obscure reason there seems to be an impression that Middlesbrough is a very dirty industrial town. My views do not give me this impression and although it would be futile to say there is no pollution from industrial sources, the town compares very favourably with many Lancashire and Yorkshire manufacturing towns. Moreover, there is a very beautiful stretch of country within easy reach. Here again, this afternoon you will have an opportunity of forming your own ideas.

Other Parts of Tees-side

So far I have spoken mostly about my own area but I am perfectly certain there are other areas of Tees-side affected by a smoke nuisance. About a year ago the Public Health Committee of my Council decided to circularise all local authorities on Tees-side with a view to forming a Committee to explore this problem on a wider scale, to exchange views and experiences, and possibly make a combined effort to reduce this common nuisance. A very ready response was made which is most encouraging as this indicates a keener appreciation among members of local authorities than has hitherto been the case. I am a firm believer in the help which an enlightened public opinion can give to this problem. For too long now the general public in industrial areas have been subjected to the evils of a polluted atmosphere and the sooner people refuse to tolerate these conditions, the sooner steps will be taken to effect an improvement. A Committee composed of members of all local authorities on Tees-side, from Darlington in the west, to Loftus in the South and the Hartlepoons in the north, has been formed and it is confidently hoped that eventually much useful work will be done. Already, local authorities have agreed to instal a total of forty-three deposit gauges which, in time, will give an overall picture of pollution on Tees-side. In Billingham we have been taking observations since Septem-

ber, 1947, and, as I have already indicated, some very surprising results have been shown. You may well ask what is the use of a survey of this description in combating the smoke nuisance. I would confidently suggest that after sufficient evidence is available a meeting between local authorities and industrialists be held and the whole question be discussed in a friendly, amicable way in much the same way as we have discussed our problems in Billingham.

Friendly Consultations Needed

It has been suggested to me that all firms are not so co-operative as I.C.I., but I have sufficient faith in human nature to believe that if the position is put fairly and squarely before a body of representative men, they will not refuse to shape up to their public responsibilities and make determined efforts to bring about a lessening of this very real and largely unnecessary evil. I am ignoring the legal aspect as I think more can be done by friendly negotiations than by invoking the law which, as many of you know, is quite inadequate for present day needs. Joint consultations would also help to avoid repeating past mistakes so far as the siting of industry is concerned, which might be a future cause of nuisance. A bit of good will is worth a great deal of compulsion. Smoke pollution has no respect for boundaries and at times a large part of the Tees-side area is simply obscured by a pall of smoke.

I cannot help thinking that if these conditions applied to other towns, for example, Bournemouth or Blackpool, there would be such a public outcry that steps would very quickly be taken to remove the cause of the trouble. I once read an article which suggested that anyone who made more than £10,000 should be compelled to live within a mile of where the money was made, the inference being, I take it, that such a person would not be able to escape the effect of any anti-social actions. The idea, however impractical it may be, certainly provides much scope for one's imagination for action which would have a very salutary effect.

The Wolverhampton Corporation Act

The latest local Act to include sections for the approval of fuel-burning installations and the establishment of smokeless zones is the Wolverhampton Corporation Act, 1950. An important change from similar recent Acts in the smokeless zones section relates to the position of electricity generating stations and gas works. Adopted in the first instance in the Bolton Corporation Act, 1949, these were fully exempted from the provisions of the Act, a typical sub-section reading as follows :

Nothing in this section or in any order made thereunder shall apply :—

(a) to any existing generating station of the Electricity Authority or to any existing works of the Gas Board for the manufacture or storage of gas ; or

(b) to any generating station or works for the manufacture or storage of gas permission for the construction or extension of which by the Electricity Authority or the Gas Board (as the case may be) is granted or deemed to be granted in accordance with the provisions of the Town and Country Planning Act, 1947.

In the Wolverhampton Bill, and therefore probably in other Bills of a similar nature that may be introduced by other local authorities in the future, this was amended by Parliament to read as follows :

An order under this section may be :—

(a) varied or revoked by another order made by the Corporation and confirmed by the Minister in like manner ; or

(b) varied by an order made by the Minister on the application of the Electricity Authority or the Gas Board :

Provided that in relation to an order under paragraph (b) of this sub-section :
(i) before making application to the Minister for such order the Electricity Authority or the Gas Board (as the case may be) shall give notice to the Corporation of their intention so to apply stating the general effect of the proposed order to which the application relates ; and
(ii) before making such order the Minister shall consider any representations which may be made by the Corporation and shall give the Corporation an opportunity of being heard thereon.

SMOKELESS HOMES



RECENTLY we had the pleasure of meeting some business and research visitors from Holland, and from them learned much of interest about domestic heating in that country: heating that is, needless to say, smokeless.

The open fire is not unknown in that country, but it is a rare luxury, to be found only in a few of the larger houses, and even there it is often simply a decorative imitation, the heating being by gas or electricity, perhaps even without a flue! The Dutch believe that the excessive draughts caused by an open fire are an important factor in the causation of pneumonia.

Faced with the need to import much of their fuel, and to use it economically long before we in Britain had occasion to, and with high traditions of domestic orderliness, the use of the closed stove had for many generations been universal in Holland, and this is now being replaced by the slow combustion stove. The distinguishing feature of the new type compared with the old is that it is equipped with a smoke-box and circulating system behind the stove. The smoke-box is a deep U-shaped passage between the stove itself and the flue, through which the combustion gases pass, and where in doing so that give up a useful amount of heat to the room.

These stoves have efficiencies of about 80 per cent., and as it is not expected that it will be possible to improve very much on this directly, a draught regulator that

automatically compensates for changes in atmospheric conditions and thus makes possible a steadier and more satisfactory rate of combustion, is under construction and will soon be included in the normal equipment of a slow combustion stove. Such draught regulators are also being developed in Britain.

Until this year the price at which a stove could be sold was controlled, and was based on the factors of weight of cast iron, fuel capacity, and efficiency—as tested by a Government agency. No stove of an efficiency of less than 60 per cent. could be approved, and, in fact to-day no such stove would be marketed. This interesting price regulation has now been ended, but out of self-interest and public demand the manufacturers still have their appliances tested by the authority, which also occasionally take one of their serial products from a shop for check testing. The efficiency figures are stated in the firm's advertisements, and are expected



Dutch Interior, 1950.

by the consumer, who compares them with others. Public interest in efficiency is apparently much more developed in Holland than it is here.

The Government authority concerned is the Department of Economic Affairs (Department van Economische Zaken), and the testing is done by the Applied Physical Research (Toegepast Natuurwetenschappelijk Onderzoek, or T.N.O.) at Delft.

The Fuel

Anthracite, coke, and carbonized ovoids are used, and Welsh anthracite especially is highly prized, but, as in this country, is in short supply and expensive. Coke is being used more and more, and is being produced in standard sizes, of which there are seven,



Modern Dutch stove, with 78 per cent. efficiency. Black enamel is by far the most popular finish.

These standards are imposed by the Gas Association, a combination of representatives of the gasworks and coke ovens concerns. For quality, coke is tested by the Applied Physical Research, or by an unofficial bureau. The ash content may not exceed 12 per cent., and moisture 5 per cent. There is no standard for ignitability.

Except to some extent in the neighbourhood of the coal mines, bituminous coal is little used for domestic purposes, and though it is not forbidden its use is not encouraged. All the fuels are now free from rationing, and although all are expensive coke and ovoids are relatively cheaper.

Service

Better service in the supply of fuel appears to have developed than is the case in this country. One feature is the sale of solid fuel in sealed paper bags of about 15 lb. This is very popular, especially in flats, and the bags can be stored away anywhere—even in a wardrobe. This has been done to a limited extent in Britain, but the relative price of the fuel sold thus is much higher than when buying it by the hundredweight. In Holland the extra



Coke storage in Holland.

cost is very small. The bags are automatically filled and sealed in an apparatus under Government control, so that correct weight is assured.

Instead of paper bags one firm at the Hague brings its customers their coke, anthracite or carbonized ovoids in aluminium bins. One can order one or more of these bins, for which no charge is made, to be delivered daily or as required. There is thus no need at all for storage space—one finds the fuel outside the door with the milk and the morning paper!

SOLID FUEL HOUSECRAFT

This is the title of a newly published book by Mrs. Elspet Fraser-Stephen, written in collaboration with the Technical Committee of the Women's Advisory Council for Solid Fuel, of which Mrs. Fraser-Stephen is Secretary. (Crosby Lockwood, London; pp. 118, with 32 plates and 17 diagrams. Cloth, 9/6; paper, 7/6).

Described as primarily a handbook for domestic science teachers, the book has a much wider use, and is an excellent

account of the use of solid fuel in the home, and of the appliances in which it is—or should be—burned. Rightly stressing the fact that solid fuel must continue to play an important part in our domestic economy, Mrs. Fraser-Stephen describes how to use it to the best advantage. The book is simply and clearly written, and the first chapter on "The Story of the Hearth" is good, and therefore engrossing, history. There are many excellent photographs and diagrams of the new kinds of open fires, stoves and cookers. Each chapter ends with some teaching notes and the concluding chapter treats of teaching methods with solid fuel appliances.

An N.S.A.S. photograph illustrates the effects of smoke on stonework, but there is only one brief reference to smoke abatement in the text. As smoke is one of the worst enemies of the good housewife it could well be stressed more forcibly in handbooks of this kind as one of the most important reasons—from the housewife's point of view—for the reform of the hearth and of the kitchen.



From our Photo-Library—6

A. Gordon Elvy

SMOKE v. SUN

Drop Forging

A Pollution Problem Discussed in a Paper by H. E. T. Lowbridge, M.R.San.I., M.S.I.A., Senior Sanitary Inspector, Willenhall U.D.C.

At a meeting of the Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution, held at Willenhall, on July 20th, 1950, a paper was read by Mr. Lowbridge, from which we print the section relating to the special problem from Drop Forging. The paper was followed by a contribution by Mr. M. C. Vaughan, who was a member of the Drop Forging Productivity Team referred to in the Paper, on impressions of the process as carried out in America, in comparison with this country.

AN industry of considerable importance and of some magnitude when viewed in the aggregate is that of drop forging. With the coming of the machine age and the demand for forgings in large numbers, the blacksmith, as immortalized in verse and in prose, gave way to the production of forgings by mechanical hammers.

Mechanical hammers were developed which permitted the shaping of metals of larger shapes than the blacksmith was capable of forging. Two halves of a die are made—one die being bolted to the anvil or base, and the other fixed on the drop hammer. A hot bar of metal or billet is firmly held on the anvil by tongs and the hammer falls so as to forge the metal between the two halves of the die. The falling hammer or die is of varying degrees of weight and may be 10, 15, 20 or 25 cwt., and larger or smaller according to the size and nature of the metal to be forged. These comments are concerned with steel drop forgings.

With smaller drop forgings, coke breeze is often used, from the combustion of which there is little or no nuisance. For the heavier forgings such as motor car connecting rods or spanners say 18 inches long, the heat in the furnace may be obtained from oil or

a mixture of creosote and pitch. In Willenhall the largest firms of drop forgers have approximately 50 furnaces each.

The furnaces do not appear to conform to any scientific design and there is a noticeable lack of standardization in the nature of furnaces. One type of furnace is constructed of a metal framework having a combustion chamber, say 3 ft. x 3 ft. x 3 ft. 6 in. deep. The chamber is lined with refractory bricks and has openings for a burner and air supply and for the feeding of the billets of metal to be heated and a chimney opening for waste products of combustion. Air supply is produced by fans. In some instances pre-heating of the air is brought about by arranging for the airduct to be brought through the furnace. The practice of pre-heating of air supply is not universal. Control of the air supply is by a damper and is operated invariably as is the supply of oil, by the operator who, in most instances, is also responsible for the feeding of metal to the stamp and furnace. Heating of the liquid fuel in the storage tank is achieved by means of electricity or steam, and heating along the supply lines to the burners by a steam pipe running parallel or by an electric booster near the furnace.

Generally, the method of operation follows the principle of one furnace per stamp, but instances can be given where there are four stamps per furnace and, of course, four inlets in the furnace for the feeding of billets.

The greatest smoke troubles occur during starting up in the morning and after the lunch interval. Most of the works keep the furnaces moving during the ten minutes mid-morning and mid-afternoon breaks, but in some works

the oil is shut off to economize in its consumption, and to give the furnace a "rest." To avoid smoke being emitted following these break periods, and the continual feeding throughout the day of cold or semi-cold billets into the furnaces, needs extreme care to be paid to all aspects of the combustion process, if nuisance is to be avoided. As with other forms of smoke producing apparatus, the operator is often unable to see the chimney top and is unconscious of the smoke emitted. An effort is being made to encourage the use of a gas torch for starting up furnaces from cold in place of the oily sacking which has been the custom in the past.

There appears to be a need for an authoritative statement upon a standard type of furnace designed for the particular process of drop forging giving the proper setting of the burner in the furnace wall, the arrangements for admission of air and particularly secondary air, and other factors mentioned later.

Productivity Team Report

A report of considerable interest on "Drop Forging," the work of a Productivity Team representing the Drop Forging Industry, has just been published following a visit to the United States in 1949. The Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution is concerned only with the smoke arising from Drop Forging and I regret that there does not appear to be a direct reference in the Report to the subject. One can, however, see many conclusions arrived at by the Committee concerning American production which, if applied to plants in this country, would lead to a lessening of smoke. They are :—

"*Specialization.*—The reserving of certain furnaces for particular classes or size of work is conducive to better control over the combustion process.

The press operator or hammer man cannot possibly also effectively control the combustion

process—relative to this point the Productivity Team recommends that the hammer man (or press operator), who alone can obtain maximum utilization of every blow, should be so serviced that he performs no unproductive work. He must not be limited by having to perform the ancillary of fetching bars or pieces from the furnace, passing forgings for clopping and so on."

In far too many instances we see the furnace men doing all these duties and endeavouring to control the furnace at the same time; if good conditions of combustion are to be obtained and maintained, it is submitted that constant supervision is an absolute essential. The report continues :—

"It is also noted that in America the rate of heating is lower, control of the furnace temperature and conditions is much better, and that production was never hampered by lack of furnace capacity. The adoption of British Drop Forges of larger and better furnaces is a matter for urgent attention."

This Productivity Team report is so much in harmony with our preachings on Smoke Abatement that its implementation by manufacturers in this country would be hailed by all of us who are concerned in a reduction of the smoke menace.

—In answer to the question "Does the technique used in America for drop forging give a greater output than in Britain?" Based on a comparison of some twenty forgings, the Committee report that the American forge will produce up to 400 per cent. more forgings per hour than its British counterpart.

In considering an industry such as drop forging, a local authority is ever mindful that the provisions relating to smoke contained in the Public Health Act, 1936, do not extend to the process so as to interfere with or obstruct the process. As to whether or not these provisions are still just towards the public and manufacturers concerned, can only be decided after consideration

of the various methods now available for the carrying on of the industry.

Recommendations

Comment has already been made upon the slogan "Black Smoke is Preventable," then it is submitted that to achieve the condition of the industry being carried on without injury to the air we breathe, when using liquid fuels attention needs to be paid to the following points :—

Furnace of adequate design.

Properly designed burner, and the burner to be carefully aligned in the furnace wall.

Adequate control over fuel and air supply, particularly when starting up from cold or semi-cold or when feeding the furnaces with quantities of metal or billets.

The lighting of furnaces with oily bags when starting from cold is a practice to be deprecated, portable gas torches are available and in use in some instances.

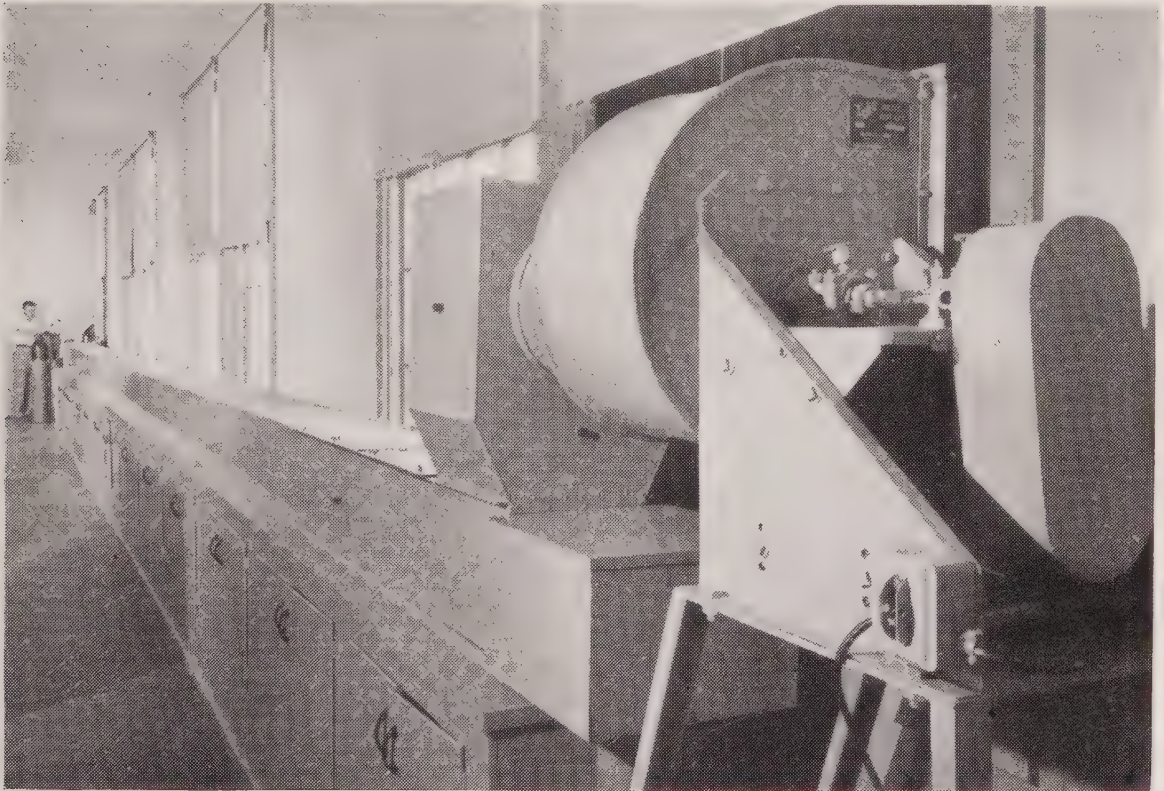
Control over fuel supply, in

storage tanks and along pipe lines, pre-heating of fuel from storage tanks to burners to ensure "atomisation," sludge deposits in storage tanks should be guarded against. Specialization or utilization of furnaces for one class or size of work.

Adequate supervision over the combustion process, this supervision should extend over the maintenance of the plant, e.g. cleansing of burners, etc.

In considering the problem of carrying on the industry of drop forging with the use of liquid fuel we must not overlook the alternative means of combustion, e.g. electricity and gas. Although pulverized fuel is used elsewhere for the process, it does not appear to be used in Willenhall.

The problems which confront us are concerned with steel and consequently the temperatures required in the furnaces are high compared with the temperature required for alloys. The



The Transmissometer. An instrument in use at the Stanford Research Institute, California, for measuring the obstruction of light by air pollutants. An air chamber 40 feet long connects the operating equipment to the blower-exhaust section, right foreground. An arrangement of mirrors makes it possible to reproduce conditions equal in effect to an 800 feet transmission.

(Photo by courtesy of Chemical Engineering, New York)

use of electricity in the industry is in its experimental stages. Induction heating has been introduced for drop forging and if it can be developed to satisfy the requirements of the trade, will, of course, satisfy us in eliminating smoke.

It may be that the average sized drop

forging manufacturers in this country do not produce sufficient similar sized forgings in repetition to make it economical to instal induction heating which is at present costly, the coils are expensive to produce and to replace. In these instances it would appear that specialization offers greater possibilities.

Drop Forging : American Impressions

by

**M. C. Vaughan, Member of the Governing Council,
National Association of Drop Forgers and Stampers**

I UNDERSTAND that members of the Midlands Advisory Council for Smoke Abatement are interested in getting an authentic background to the principal industries in the area. As a drop forger I have been asked to tell you something about my own industry. The presence of several of my colleagues on the local advisory panel will convince you that drop forgers have a growing interest in the cause of smoke abatement, the importance of which Mr. Lowbridge and Mr. Farquharson have so graphically stressed.

The products of the industry are essentials in almost all fields of engineering, but its largest customers are the motor and aircraft industries. An average car contains about 400 lbs. weight of forgings in the form of crankshaft connecting rods, etc. The turbine blades of your jet engine are drop forgings. The industry is not a large one; it employs about 15,000 men in England and Scotland and produces about 300,000 tons of forgings annually.

The chief centres of the industry are Birmingham and the Black Country, Coventry and Sheffield. Willenhall lays a strong claim to having produced the first drop forging—about a century ago. These were keys for the lock trade, though nowadays the connection between the two local industries has ceased. The trades origins are a little obscure, not because they were enveloped in smoke, but because rapid expansion only started with the growth

of mass production. This occurred in the 1870's with the development of the bicycle, and at the beginning of the present century with the advent of the motor car. In America the drop forgings received their first impetus during the Civil War of 1860-65, and it is still unfortunately true that weapons of war still make one of the chief calls upon them.

Though our products are mostly used for mass produced articles, the machines which make them cannot be mass produced. As it is very rugged it is expensive. Taxation at its present level places an intolerable burden on the manufacturer who wants to keep his plant up-to-date. In spite of this, a very lively policy of development in the technical and welfare fields is being fostered by the National Association of Drop Forgers. This body took the initiative in sending the third of the Productivity Teams to visit the United States under the auspices of the Anglo-American Council.

The report of this Team is being considered with great care so that its recommendation can be implemented with the greatest impossible advantage.

Furnace Design

As smoke abatement experts, you will be interested to know that a Technical Committee of the industry is studying recommendations on the improvement of furnace design, which is one of the fields in which the Americans are more advanced than we are.

The fuels used in the industry in this country are oil, gas and electricity, the last being in a very small minority. I should say that hardly any bituminous coal is now used. The oil varies from fair light distilled grades to residual oils of a viscosity of about 950° seconds Redwood. It is most often fired by one or two burners into a box type furnace, the forging bars being inserted in slots at right angles to the burner. This design is widely favoured because of its flexibility in accommodating the wide range of bar sizes for the multitude of jobs which are an essential feature of the industry. High thermal efficiency cannot be expected of this type of furnace, but it can be increased by use of insulating walls and intelligent firing. In the same way, and by good burner design, the emission of smoke can be reduced to very small proportions.

The Americans design and build their furnaces better than we do, but their accent is on keeping a steady flow of steel to their producing unit. They cannot, therefore, show us anything regarding fuel efficiency; their fuel is so cheap that they do not try.

In America the control of the furnace is not in the hands of the hammer operator. The furnace man's job is to supply him with heated steel. He feeds the furnace and controls the combustion under the general supervision of the foreman. Many furnaces have pyrometers. Where these are not provided the foreman has an optical pyrometer.

The furnace man is paid a direct proportion of the hammer man's earnings, usually about 80 per cent. The hammer man is paid either straight piece work or a day rate with a production target. If the latter, it is rigidly adhered to and the man is soon sacked for falling below it.

Mr. Lowbridge has asked whether piece work is detrimental to the industry. In the English system, I don't think dismissal for falling short of the target would be tolerated. If piece work were discarded, production per man would drop by leaps and bounds.

Gas and electric furnaces have been developed more in the U.S.A. than they have here.

The greater quantities of a similar article to be produced enable them in many cases to discard the general purpose furnace in favour of the specialist furnace. This is sometimes fired by gas with a moving hearth working on a time cycle, which conveys pieces of metal which have been previously cut to length. Another solution is the high frequency electric induction furnace. The pieces of metal are conveyed through a tunnel surrounded by wire coils carrying a high frequency current. This induces heat in the forging metal with absence of oxidation and complete absence of smoke or extraneous heat.

Some such furnaces are in use in England in this industry and a very considerable success is claimed for them, particularly on specialised classes of work. A great deal of development is being put in on them though there are still a number of reasons why they are not suitable for the general run of jobbing work. Their advantages are such that their perfection is highly desirable from many points of view and it is to be hoped that the next few years will see the solution of their remaining problems. At present, the scarcity and comparative high costs of electricity greatly restrict their installation and they have so far not entered the field of jobbing work.

Legislation in the U.S.A.

—concluded from p. 37

of cities are supplementing the approval and certification of new or altered fuel-burning equipment. Rigid control over the use of volatile solid fuels is another current development in smoke prevention which only a few cities had utilized prior to the last war."

In view of the very slow approach in this country towards what we call "prior approval" it is interesting to note that in the States this is now required by "the majority of cities" (34 by 1948) and that, as the above quotation shows, this is now being extended by provisions for subsequent annual inspections.

Smoke Observation Training

By Harry E. Kunkel*

A Paper Presented at the Annual Convention of the Smoke Prevention Association of America, at Montreal, Canada, May, 1950

Training personnel in the science of reading smoke opacities, without reference to the Ringelmann Chart, is of necessity an important part of any smoke abatement programme.

Section 24242 of the California State Health and Safety Code reads as follows:

A person shall not discharge into the atmosphere from any single source of emission whatsoever any air contaminant for a period or periods aggregating more than three minutes in any one hour which is :

- (a) As dark or darker in shade as that designated as No. 2 on the Ringelmann Chart, as published by the United States Bureau of Mines, or
- (b) Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in sub-section (a) of this section.

Obviously, it is impractical to use the official Ringelmann Chart in an automobile following a smoking Diesel truck travelling the highways at forty or fifty miles per hour, or to determine the opacity of contaminants being discharged into the atmosphere other than black smoke.

It was, therefore, necessary to provide procedures in making such observations that will comply with the State Health and Safety Code and the provisions of Information Circular 6888 as published by the United States Bureau of Mines, which states, "Observers with proper experience find it unnecessary to continue to refer to the chart."

To insure a maximum degree of accuracy in all smoke observations,

the Los Angeles County Air Pollution Control District, in co-operation with the County Civil Service Commission, established a "Smoke School" at which inspectors and engineers are trained. Before an inspector is permitted to make formal smoke observations, he must have graduated from the smoke school and be able to record smoke opacities with a maximum deviation of less than one half Ringelmann number.

All inspectors are returned to the smoke school at least once every two months for a refresher course to test and check their accuracy in recording smoke densities.

In most instances it has been found that an inspector's accuracy becomes more nearly perfect—as he gains by experience.

Successful procedure in such a training programme requires that means be provided by which desired smoke densities may be produced. It is also necessary that smoke densities be held constant for definite periods of time and the densities be varied at the will of the instructor.

To accomplish these objectives, the Los Angeles County Air Pollution Control District constructed a smoke producing apparatus, complete with photo-electric cell-type smoke indicator and calibrated in per cent. density and Ringelmann number. The only part visible to the observer is the smoke stack projecting through the roof of an 8 x 12 building housing the equipment. Development of this equipment and technique of operation was started in June 1948 shortly after the district was fully staffed. Its use and the procedure used in training inspectors follows :

Diesel fuel is metered to a rotary oil

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burner by means of a needle valve. In this manner, various air-fuel ratios may be obtained, thereby making it possible to produce black smoke of any density and to vary that density at will of the operator. When the instructor desires a smoke reading be made he sounds an electric bell which is audible to all observers. Several readings per minute may be made; the instructor making certain the smoke density is constant before signalling for a reading. The smoke indicator is mounted within easy view of the instructor. Upon signalling for a smoke reading, the instructor, or his assistant records the actual smoke density indicated on the meter.

White smoke may be generated by fuming rosin, but since the difficulty is in producing and controlling the desired densities, other methods are being devised.

When a training period has been completed, the instructor compares the actual smoke densities he has recorded with those recorded by the inspectors on forms provided for that purpose.

Observers stand at varying distances

from the stack and position themselves so they are looking at right angles to the column or trail of smoke and not facing the sun.

When the inspector hears the bell he immediately observes the smoke and records its opacity.

During initial training periods, observers glance from the smoke as it issues from the stack to an official copy of the Ringelmann Chart, published by the United States Bureau of Mines, which is mounted in line with the stack. After several such training periods, the Ringelmann Chart is removed and the observers are required to judge and record smoke opacities without reference to the Chart.

Upon satisfactory completion of the prescribed course a Certificate is issued to the inspector indicating his qualification as an expert in visual observation and recording of smoke densities.

These Certificates have been recognised, and the inspector qualified as an expert and his testimony as such accepted by the courts.

Legislation in the U.S.A.

We have received from the American Municipal Association a copy of a report on "Smoke Abatement: Current Practices and Regulations," first published in 1948 and reprinted (in duplicated form) in 1948. (American Municipal Association, 1313 East Sixtieth Street, Chicago 37, Illinois).

It is, especially for us in Great Britain, a most useful summary and reference book, for since American legislation on smoke prevention is a city or county matter, it is difficult to keep well-informed of all the varying ordinances and the frequent changes that take place.

In this report the main trends of modern legislation are analysed and discussed, and the various factors involved, which may require different treatment in different cities, are considered. The part played by public relations is stressed, and how the co-

operation of voluntary organizations may be secured is indicated. There is also a table or check-list of ordinance provisions for the cities from which information has been obtained. To quote from the introduction to the report:—

"Since the end of World War II, more than 25 cities have adopted a definite and more effective programme of action to reduce contamination of the air we breathe. In addition to prohibitions against the emission of dense smoke, regulation is being extended in many cities to cover fly ash, fumes, noxious gases, and other air contaminants. Several cities are requiring that the sale of combustion equipment be reported to smoke control authorities as a means of securing compliance with installation requirements. Annual inspections in an increasing number

(Concluded p. 35)

NEWS FROM THE DIVISIONS

As mentioned in the editorial notes, a meeting was held in Birmingham on July 4th, at which it was agreed to set up a **West Midlands** Divisional Council. The chair was occupied by Alderman F. W. Perry, of Smethwick, and the meeting was first addressed by the West Midlands representatives to the Executive Council—Dr. W. R. Martine, Mr. G. W. Farquharson and Mr. C. A. Stansbury—and by Mr. Arnold Marsh, General Secretary. A provisional committee was elected to draft a constitution and prepare a programme, and Mr. Farquharson was appointed Hon. Secretary.

The Annual General Meeting of the **East Midlands** Division was held in Nottingham on July 6th. The Chairman elected for the year was Councillor the Rev. A. Brooke Westcott, of Corby, Northants, U.D.C., and the Deputy Chairman, Councillor S. Jennings of Bolsover, Mr. Alfred Wade, of Nottingham, was re-appointed Hon. Secretary. After the business meeting an address was given by Mr. Arnold Marsh, General Secretary, in which the present position of the movement and the progress of the Society were surveyed. A number of questions and some interesting discussion followed. Members were guests of the Chairman and members of the Nottingham Health Committee for tea.

The **Yorkshire Division** met at Kingston-upon-Hull, on July 17th, and were welcomed by the Lord Mayor, Councillor Henry J. Barney, J.P. After the business meeting a visit was made to the laboratories of the City Analyst, Mr. D. J. T. Bagnall, who explained and demonstrated the apparatus used for recording and analysing atmospheric pollution. Later, the party were the guests of the Lord Mayor at the Guildhall, for tea.

An important new development in the organization of the Divisional Councils is that the local authorities in the **Tees-side** area, which some time ago had set up an informal committee,



Members of the North East Division on the vertical lift bridge over the Tees during the meeting on 6th June.

have now agreed that this should be a committee within the North East Divisional Council of the Society. Local authorities in the area that are not already members of the Society are being urged to become members so as to be able to co-operate. This is the first instance of district organization within a Division and sets an important precedent that in time may be followed elsewhere.

Manchester's Smokeless Zone

The Manchester Health Committee has recommended to the City Council that steps now be taken to implement the provisions of the Manchester Corporation Act, 1946, for setting up the first smokeless zone in the central area of the city. The *Manchester City News* says of this: "Now at last the crusade quietly carried on by the apostles of the Smoke Abatement Society is nearing recognition and success . . . we have no hesitation in affirming that the creation of this smokeless zone will constitute the greatest single reform in the history of Manchester."

Smoke Prevention Abstracts

156. London Fogs—Then and Now, Bonacina, L.C.W. (Weather, Mar. 1950, 5, 91-93). The incidence of heavy smoke pollution of water fogs in the London area has decreased since 1910 from regular black fogs to occasional much lighter ones, due to reduction in crude coal consumption and better drainage of central areas. Temperature inversion conditions producing low cloud blackout have also been affected by smoke reduction. White water fogs over the country are still as dense as ever.

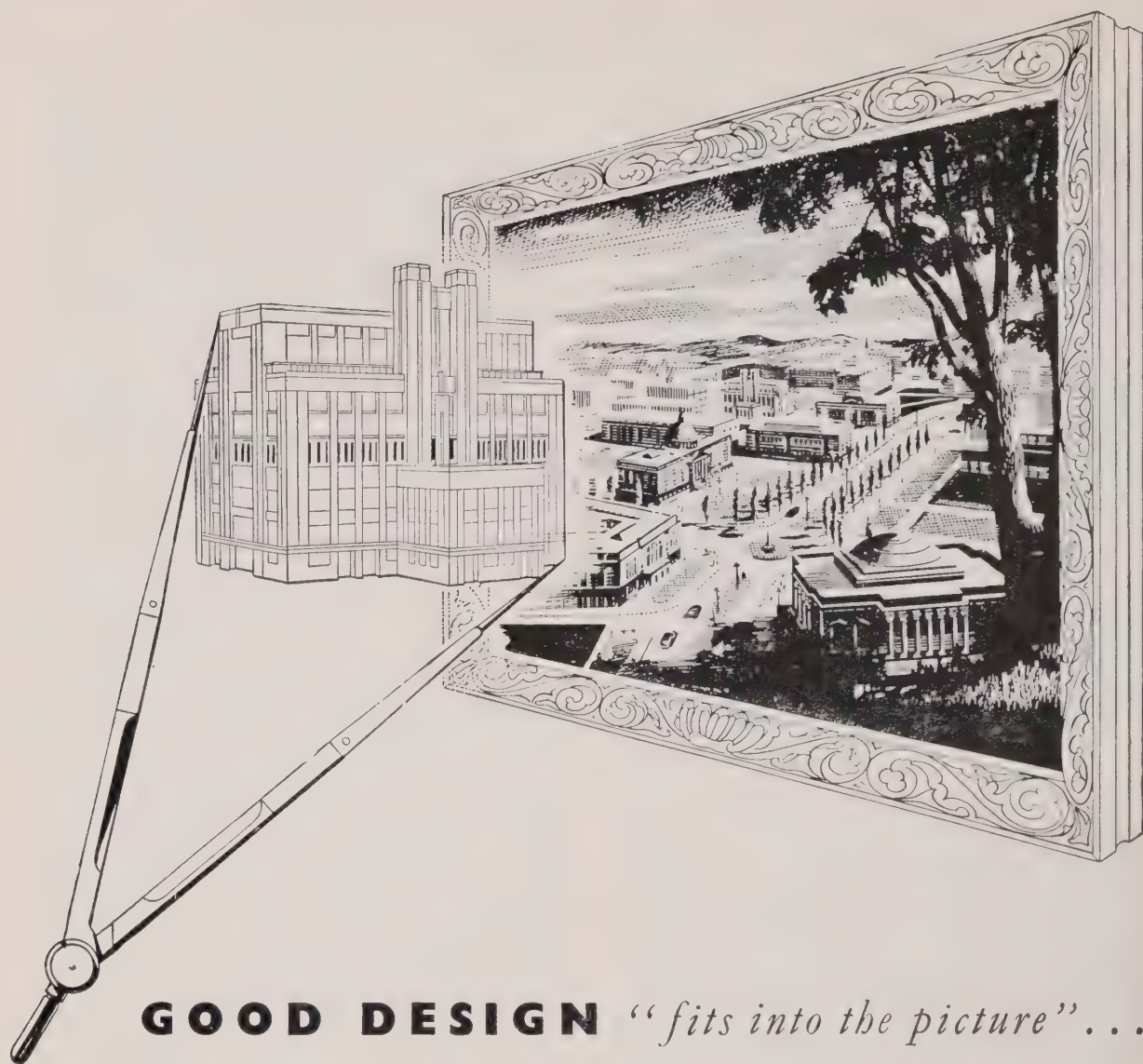
157. Dust Deposition from Chimney Stacks, Bosanquet, C. H., Carey, W. F., and Halton, E. M. (J.Inst.Mech.Engrs., Apr., 1950, 76). The problem of designing an installation to avoid nuisance is to remove the coarser grits in a deduster and to arrange the stack to dilute the finer residue so that deposits will not be noticed. The authors have developed a set of reasonably simple formulae and charts for predicting the path of particles emitted from a stack and spread by the wind. Experimental checks have been applied to the predictions, but the subject is complex, and at this stage it is unlikely that it will be possible to predict the rate of deposit within a factor of two. In order to illustrate the implications of the paper a worked example is given on a powdered coal boiler installation. This shows that with properly designed cyclones and a moderately high stack there will be no noticeable deposits. The implication is that it should be possible in time to extend the treatment given in the paper to specify a deduster exit that will avoid nuisance with fair certainty and at a relatively moderate cost.

158. "Jay-Gee" Smoke Eliminator. (Locomotive, No., 1949, 55, (687), 172, 173). Particulars and drawing of the "Jay-Gee" smoke eliminator and fuel economiser designed to supply secondary air for the combustion of volatiles. The secondary air is drawn through scoops at the side of the smoke-

box and injected via some of the lower tubes into the fire-box below the brick arch, entering at high velocity; complete turbulence and combustion of the unburnt hydrocarbons is effected. The device has been under test on 12 locomotives of the Eastern Region, British Railways. It is claimed that by the use of this device an 8 per cent. saving of coal consumption is effected. On one locomotive so fitted it is stated that neither the smoke-box nor the tubes were swept for five weeks.

159. Air Pollution in Denmark. (Copenhagen: Trans. Danish Acad. Tech. Sci., 1949, No. 4, 72 pp.). A preliminary report on investigations of atmospheric pollution in Copenhagen. Data for pollution by solid particles and sulphur dioxide are given. The high content of fly ash is due mainly to present use of domestic lignite and peat. The effect of wind is to spread pollution over a wider area.

160. Smokeless Combustion of Bituminous Coal. (Ellis, Sir Charles, Pres. Address, Brit. Coal Utiliz. Res. Asscn., Quarterly Gazette of the Asscn., Spring, 1950). During the course of researches it was found that if certain gases were added to the air passing through the fuel under conditions of forced draught, the formation of soot particles was greatly reduced. CO₂, N₂, and H₂O vapour are all useful in this respect and all are constituents of the flue gases. Work on systems of recirculating the flue gases through the fuel bed is now progressing, the applications of which are not confined to domestic appliances but may be more practical on large appliances. E.g., boiler availability is a pressing problem in electricity generation because, owing to deposits forming on the heating surfaces the boilers may be out of action for considerable periods. Recirculation of flue gases has a marked effect in reducing the amount of sulphuric acid produced and the overall amount of deposit formed in the cooled tubes exposed to combustion gases,



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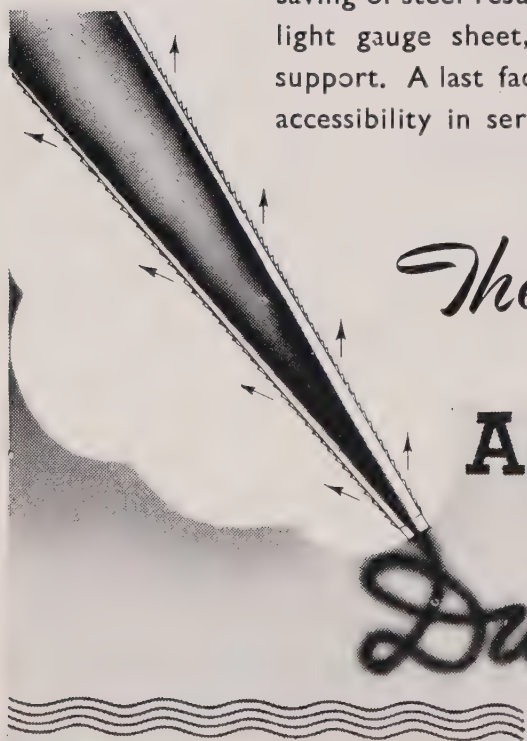
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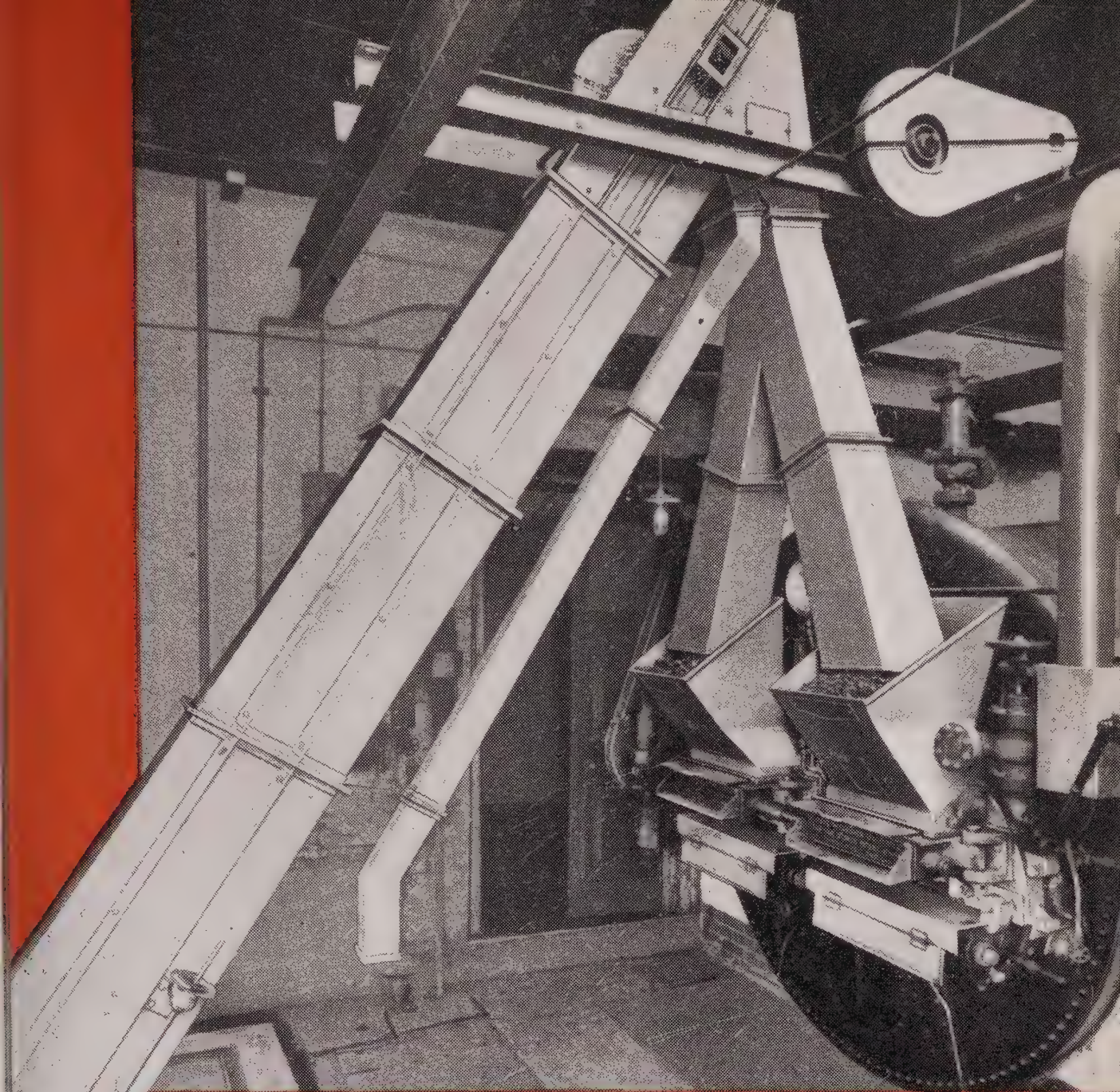


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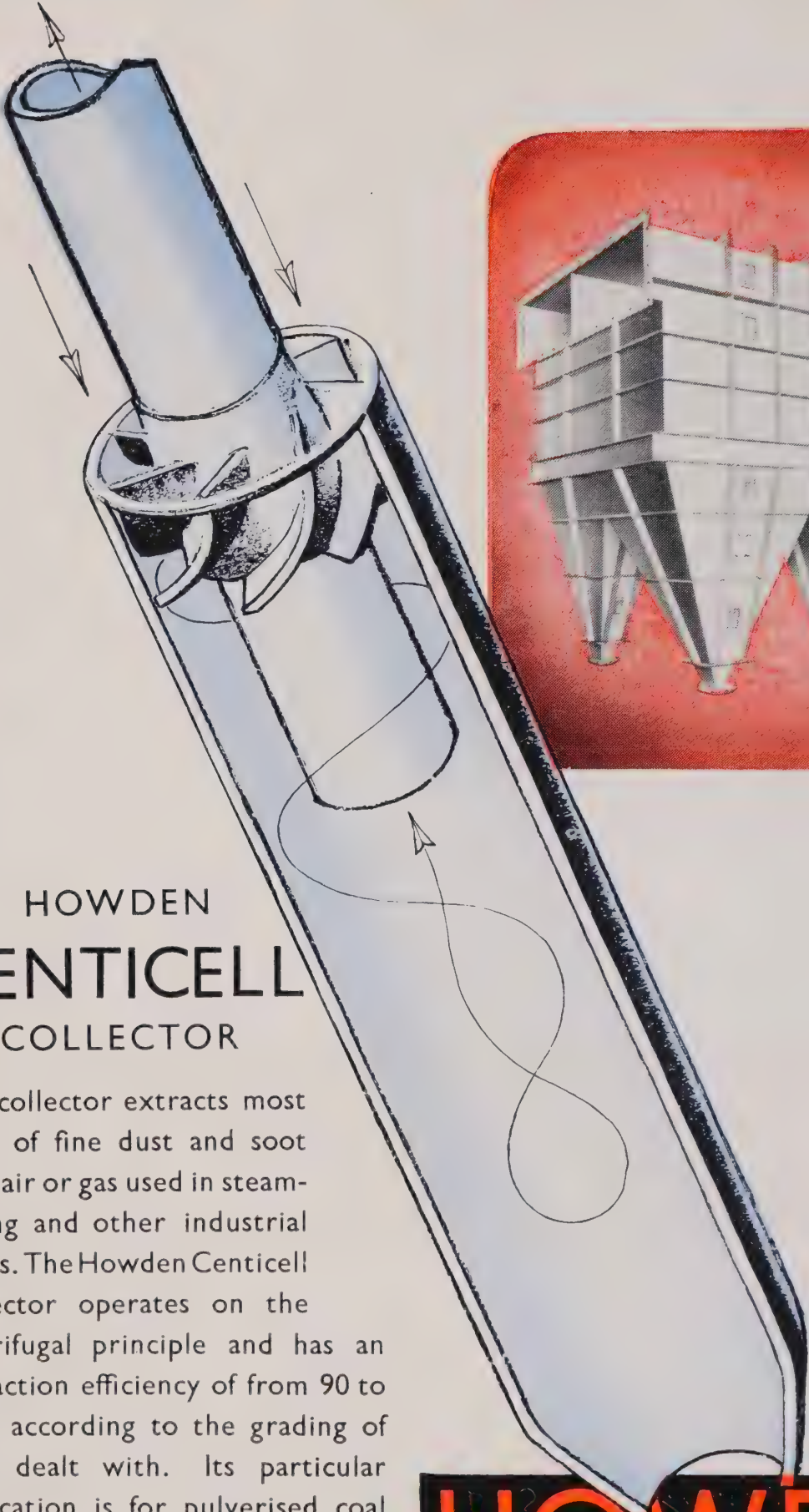
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 76

WINTER

1950

ONE SHILLING

In this Issue

Charles Gandy

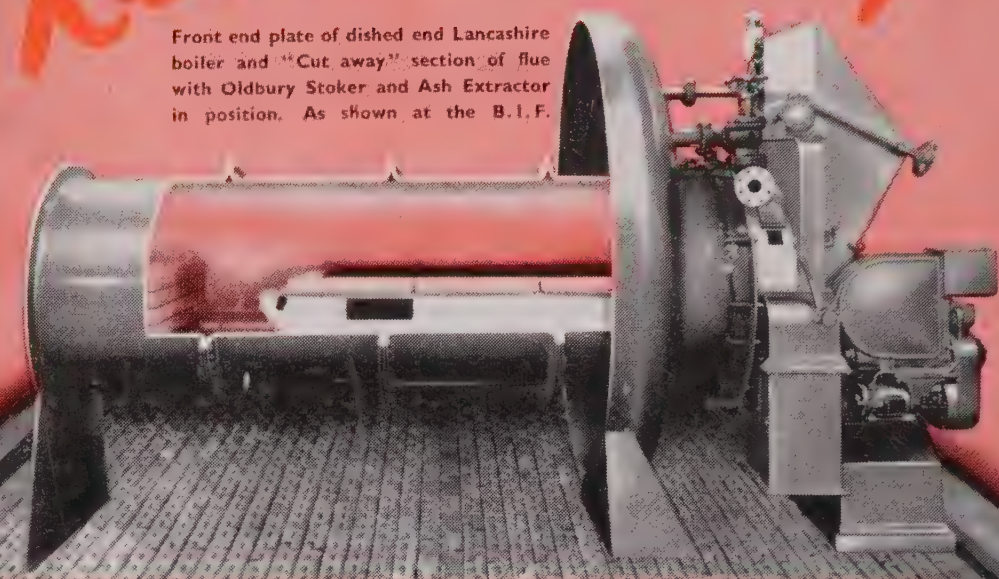
Margate Conference Electrical Research
Smoke Prevention Trends in the U.S.A.

G. B. Shaw on Smoke and Genius

Smokeless Fuels Review

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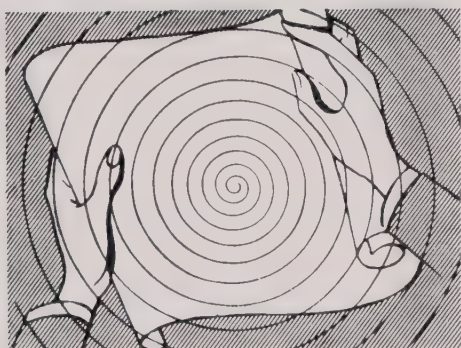
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SMOKELESS AIR

Vol. XXI. No. 76

Winter, 1950

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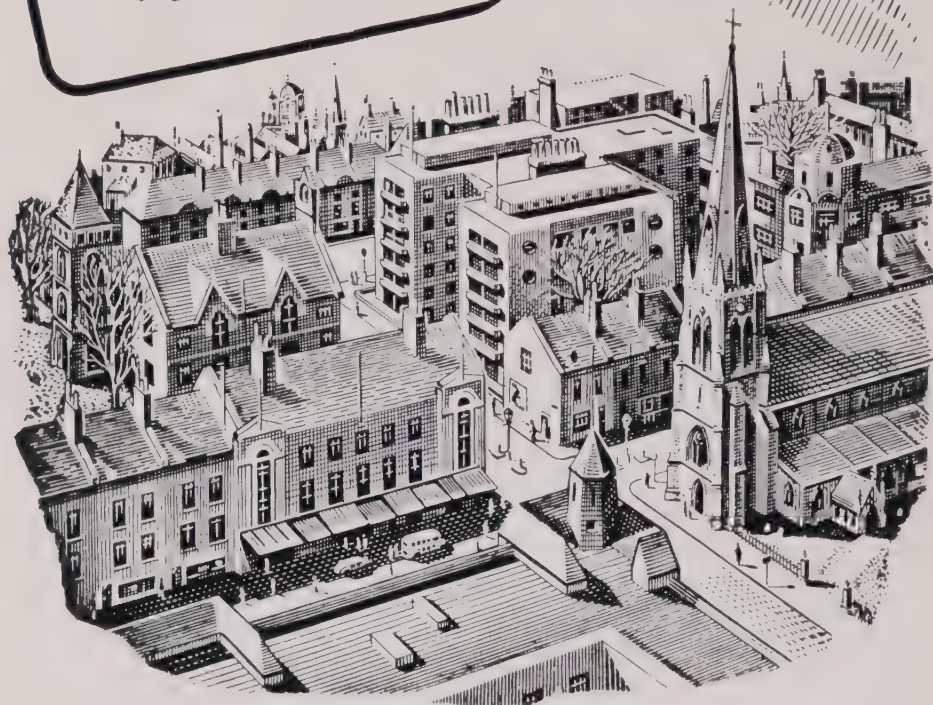
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SMOKELESS AIR

C. G.

THE celebrations of the Society's coming-of-age, the highly successful conference at Margate, and the important Fuel Efficiency Exhibition in Manchester, have all been sadly overshadowed by the sudden death of our Chairman, Charles Gandy. He was present at the Margate Conference and was to have been on the platform at the opening of the exhibition to second a vote of thanks to the opener, Lord Hyndley. A short memoir and some appreciations appear on another page, and here we need only add that the Society has lost much more than a

Chairman, although his influence will remain active and helpful for many years to come.

Margate

Some of the cream of the things said at Margate is given elsewhere in this issue, and the complete *Proceedings* will shortly be published. Only those who were there, however, can appreciate how well everything went, from the President's delightful address on the Wednesday afternoon to the last discussion, on railway smoke, on the Friday. The first Des Voeux Memorial Lecture was outstanding, and the

Society owes a great debt to Dr. Townend for having set so fine a standard for these lectures. The only problem will be to keep it up! The other papers were first-class, and the discussions brought out very clearly what is one of the Society's unique characteristics—an audience so remarkably representative of so many different sections of the community. There is the doctor, the scientist, the municipal councillor and his officer, the miner and the miner's wife, the engine-driver and the administrator, north and south, east and west. There is no dead level about a N.S.A.S. conference discussion. True, there are usually a few anxious moments—an occasional note of political bias, a minor *faux pas*, and—on this occasion—concern about how the story of the harem was going to end—but these are the spice of conferences. There is now even a hardy perennial contribution, which, whatever else may be thought of it, has at least the merit of giving a sense of continuity to the conferences.

Semi-Smokeless Zones?

At the Margate conference Mr. J. S. Williams, its Director, made a statement on behalf of the Coal Utilization Joint Council, of which the gist was that if there were too many smokeless zones too soon there might not be sufficient smokeless fuel for them, so that they would fail and the whole idea would be discredited. He suggested that there should be zones of cleaner air instead, where modern appliances would be installed, but where there would be no restriction on fuel or smoke emission. This ingenious suggestion did not appear to be received with any enthusiasm, and although it would take much space to analyse it in detail and in comparison with the smokeless zone principle, there are one or two comments that may be made. First, an indeterminate scheme of such a kind would have neither the material nor the educational advantages that are anticipated from the smokeless zones, and secondly there is no reason to suppose that any smokeless zone will be declared, or that the Ministry of Health would

give its approval to such a declaration, before the supply of smokeless fuel in the area is assured. We know that this will call for patience, but it seems better to go slowly in the right direction than to hurry to so vague an objective. *And* it is more likely to lead to more smokeless fuel. Moreover, it is generally agreed that when eggs are scarce it is better to give them to those who need them most than to offer everyone a small morsel of omelette; and similarly another reason for smokeless zones is that areas which are most urgently in need of smoke abatement should have first consideration. A smokeless zone in Salford, for instance, will be more beneficial than "cleaner air" zones in that city and in Malvern. But these are first thoughts on the idea; we should like to know what readers think.

Pats on the Back

The Society has had many kind and encouraging words said about it on its coming-of-age, and we have already reprinted a *Times* leading article. More recently, an editorial in the *Gas Times* has said, among other complimentary things: "During its 21 years the Society has done a vast amount of work. It has initiated new ideas, it has preached the evils of smoke up and down the land with a zeal that bears comparison with that of the apostles of any great cause of our times. Most important of all it has aroused the civic conscience of Britain."

An editorial in *The Medical Press* must be quoted more fully: "There can be few voluntary bodies in this country which have attempted a more discouraging task, for smoke abatement begins with an attack on certain principles which the Englishman cherishes. It not only seeks to tell him how to run his business, but pursues him with an accusing finger into the fireside chair which is at the heart of his private domestic life. He is reconciled to having money taken from him by the Exchequer and used for the benefit of the public health, but he will be damned rather than put his hand into his own pocket and spend part of what the Exchequer has left him on fitting his

factory or his house with new-fangled apparatus just because some crank thinks it in the public interest. Defiantly he asks: "How can you tell that trade's good and factories working if you can't see t'smoke?"

"However, the list of foolhardy eccentrics who form the Society is growing so steadily that they are ceasing to wear the 'crank' label in the public's eye. In fact, interest in smoke abatement is becoming one of the recognized hall-marks of the man or woman with a practical social conscience, and the Society deserves, perhaps, its greatest credit for working this change in the public's approach to the question. Smoke abatement is essentially a matter of thorough public education, and from the long-term point of view it is more important to say. 'In 21 years we have made the public smoke-conscious' than to put forward a long list of commercial undertakings which have turned away from soft coal to some other source of power."

The Executive Council

Among changes in membership of the Executive Council are several due to retirement of good friends who have given long service to the Society. Among these special mention must be made of the former Deputy Chairman, Mr. John W. Beaumont, of Halifax, and the former President of the Scottish Division, Mr. Allan Ritchie, of Edinburgh. Both, however, were elected as Vice-Presidents at the Annual General Meeting in Margate, so that their association with the Society remains unbroken. Mr. Beaumont was a member of the Executive Council from the formation of the Society, and Mr. Ritchie for almost as long, and a great deal is owed by the Society to each of them. Other retirements from the Council we are sorry to have to record are Mr. D. Cleave Cross, who represented the Institution of Gas Engineers, Mr. W. Wilde, of the Institution of Electrical Engineers, and Dr. Metcalfe Brown, Medical Officer of Health for Manchester, to each of whom the Society's thanks and appreciation are also extended.

The results of the elections for Divisional representatives to the Executive Council, held during the summer and announced at Margate, are as follows:

Scottish Division: John Innes, J. F. Anderson, Bailie Dr. Violet Robertson.

North West Division: S. N. Duguid, Charles Gandy, Alderman Dr. F. E. Tylecote, Dr. J. L. Burn, Dr. J. S. G. Burnett, W. L. Mather, Mrs. L. Hayhurst.

North East Division: Alderman P. S. Hancock, Alderman J. Chapman, G. W. Tate.

Yorkshire Division: James Law, James Goodfellow, Dr. I. G. Davies, A. C. Saword.

West Midlands Division: G. W. Farquharson, C. A. Stansbury, Dr. W. R. Martine.

East Midlands Division: A. Wade, Councillor the Rev. A. Brooke Westcott, F. G. McHugh.

South West Division: F. J. Redstone, F. R. Jefford, G. W. Dhenin.

South East Division: Dr. R. Lessing, H. G. Clinch, N. Bastable, Dr. A. J. Shinnie, J. J. Matthews, G. Nonhebel, S. R. Daly, L. A. Stroud, H. L. Snowden.

Dame Vera Laughton Mathews was re-elected President and Sir Ernest Smith re-elected Hon. Treasurer. At the first meeting of the new Council Mr. Charles Gandy was re-elected Chairman, and Mr. Sydney N. Duguid was elected Deputy Chairman.

Manchester's Smokeless Zone

The approval of the Minister of Health, required under the provisions of the Manchester Corporation Act, 1946 (and in similar Acts) has been given with respect to the first smokeless zone in the central area of the city. The smokeless zone will come into operation on 1st May, 1952. This news marks a further stage in the development of the principle, as it is the first occasion on which the Minister's approval has been sought and granted, and is consequently important for the precedent it sets.



CHARLES GANDY

CHARLES GANDY

IT is with sorrow that we have to record the death, on November 4th, 1950, at his home in Bowdon, Cheshire, of the Chairman of the Society's Executive Council, Mr. Charles Gandy. A member of the Executive Committee, as it was then called, since the formation of the Society in 1929, Mr. Gandy had occupied the Chair without a break since 1934.

Last year he had been severely ill, with heart trouble, and had been forced to be absent from an annual conference for the first time. He had, however, appeared to have made a good recovery, and those who were at Margate will remember how well he seemed, and how his old keenness and determination for the Society's continued progress had never been more evident. He was looking forward to the Fuel Efficiency Exhibition in Manchester, the first arrangements for which between the organizers and the Society were largely due to his initiative. And then came the shock of learning that he had suddenly passed away.

Charles Gandy was born in 1886 at Sheffield. His family later lived in Newcastle upon Tyne, and he was educated there, at the Royal Grammar School, from where he won a scholarship to Exeter College, Oxford. There he read classics, gaining a first in "Mods" and a second in "Greats." After leaving Oxford he did some teaching, and in 1913 went into the chambers of Mr. Bromley Eames, of the Common Law bar in London, to gain experience as a pupil. Having previously done some reading, he passed his bar final the same year. Shortly after the outbreak of war he took a commission in the Royal Artillery and soon went to France, where he remained until the end of the war, being awarded three decorations. In 1919 he married Lucienne Marguerite Lavasseur, whom he met at Le Havre towards the end of the war.

After the war Mr. Gandy joined the

Chancery Bar in Manchester, and soon had plenty of work. In time he became the senior conveyancing counsel in the city, where he had a wide and high reputation. He was also a lecturer in Law at the University of Manchester. He and his very charming wife (who, in her greivous loss, has our deepest sympathy) became active and helpful in many spheres, including, of course, our own Society, which then had its headquarters in Manchester. For many years, too, Mr. Gandy was Chairman of the Alliance Française in that city, and for this and other work—especially during the last war, he was awarded the Legion d'Honneur and a medal of the Reconnaissance Française. The very diversity of the many other bodies with which he was associated help one to form a picture of a man of wide human sympathies and of generous personality. He was deeply interested in religious matters and usually attended his parish church of St. Margaret's, Altrincham, where he was Chairman of "The Friends of St. Margaret's." (His father had been a senior minister in the body of Christians known as the Catholic Apostolic Church, and for many years he attended their services in Manchester). He was a member of the Manchester Liberal organization, of Chatham House and the Royal Institute of International Affairs, the Manchester Geographical Society, and Toc H., while during the war helped and was a member of the Masaryk Society. He served also on many housing, social service, and other committees.

Among his many activities and interests smoke abatement, and the welfare and progress of the Society stood high. For the simple natural rights of clean air and sunlight he had a love and a fervour that created in him a missionary zeal to ensure that they were enjoyed by all. In some men this would have resulted merely in a vague emotionalism, but with Charles Gandy it was allied with a practical, clear-thinking mind that had had a wide and rigorous legal training. The result was

that the Society has had the benefits and the privilege of a Chairman of fine and rare character, unwavering in his vision of the ultimate goal ; realistic in his understanding of the innumerable and ever-changing obstacles and pitfalls in the path towards it ; wise and tolerant in his understanding of others and of their points of view.

How much the Society owes to him cannot be measured nor adequately described, but, partly because of his own modesty and partly because of the very nature of his service, it is far greater than most members may surmise. The present writer is perhaps in the best position to know, having worked so intimately with Mr. Gandy for sixteen years, and he regards it as a duty and a privilege to attempt to stress the scale of the debt. It is impossible, though, to do more than to make bare mention of just a few of countless impressions—the many long and fruitful talks at his pleasant home in Bowdon, in his club in Manchester, or elsewhere ; the many hundreds of letters ; the many questions and answers ; the many ideas that were discussed and then either discarded or brought forward for more

public scrutiny ; and above all, the guidance he gave, the patience he showed, the stimulation he provided—all this, and much more, exists vividly in the memory, and one's feeling of personal gratitude and affection is something that, if possible, should be shared by all members of the Society. For it was all for the Society.

In Council he was a most tolerant Chairman, liking to hear all points of view and to depend on the sense of the meeting rather than on any numerical vote. To matters of policy he devoted much thought, especially on the principles on which sound, practical policy must be based. It is to him that the Society and the nation owes the method of progress in smoke prevention by the setting up of smokeless zones that, stage by stage, would grow into smokeless cities. It was a new idea, bold in its simplicity, and it can fall to the lot of few pioneers to see, within a single decade, a novel principle progress from its conception to the statute book itself. That is something which, in itself alone, gives the members of the Society reason to be proud of and grateful to their Chairman.—*A.M.*

Some Appreciations

It was impossible to meet Mr. Gandy without realizing that he was a man of exceptional sincerity and integrity of character, as well as great kindness. No qualities are more needed in public life, and the National Smoke Abatement Society, which enjoyed the benefit of them for so long will miss them sorely.—*Vera Laughton Mathews, President.*

The death of Mr. Charles Gandy is a grievous loss to the N.S.A.S. A year ago he was too unwell to attend the conference at Harrogate, but he was with us at Margate last September, apparently in good health, and we had hoped that he would continue to be our Chairman of Council for years to come.

He will be remembered as one of the most active leaders of our movement ; his ability, courtesy and charm were not only valuable in the proceedings of the Council, but they made him a respected spokesman in our approach to Government Departments and Local Authorities. Especially happy in his home life, his enthusiasm for smoke abatement was shared by his wife and sister, the gracious ladies who became such regular attendants at the annual conferences. It may be some consolation to them in their bereavement that their sorrow is shared by so many who are helping to promote our cause.—*Sir George Elliston, Past-President.*

Charles Gandy has been the back-

bone of the Society for many years. He maintained and enhanced its prestige owing to his fixity of purpose and his realization of what is practicable and wise and what is but the idealist's dream. Consequently he commanded universal respect in the smoke abatement movement, from which he will be greatly missed.—*Sir Ernest Smith, Hon. Treasurer.*

First and foremost the late Mr. Gandy was a good man. His kindness and courtesy charmed all those who had the privilege of coming into personal contact with him. In addition his trained legal mind and incisive manner of speaking made him a powerful advocate of the many good causes he supported so fervently. That the problem of smoke abatement should have attracted a man of the character and eminence of Mr. Gandy is a proof of the righteousness of our cause and the best tribute we could pay to his memory would be to use his life as an inspiration to redouble our efforts to further this cause which he had so much at heart.—*Sydney N. Duguid, Deputy Chairman.*

His character—like his carriage—was upright and vigorous, yet he was withal ever courteous, kindly and patient to all with whom he came into contact. His service to the cause of smoke abatement was entirely disinterested and he will ever be remembered as the originator of the idea of smokeless zones in urban areas. Now we must bid farewell to one whom we have been proud to know and whom we had learned to love and respect as a typical English gentleman.—*John W. Beaumont, former Deputy Chairman.*

Charles Gandy has been identified for many years with the movement for giving Britain clean air and he devoted to this task a stern sense of public duty and his high professional qualities in unstinted measure. During the difficult period of transition in which the character of the Society changed from a band of enthusiasts to a body largely comprising responsible Public Authorities, he presided over the

deliberations of the Executive Council *suaviter in modo, fortiter in re*, and by the charm and sincerity of his manner earned the unanimous appreciation of its members.—*Dr. R. Lessing.*

As Chairman of the Executive Council he served the Society with conspicuous success, spending a large part of his time and much energy in pressing forwards its claims. He early realized that the task of the Society had set itself would not be easy, but this only helped to spur him on. When, as often happened, new problems were presented and progress was impeded and delayed, the situation seemed only to stir him into fresh activity with stimulated keenness and determination. This made him a constant inspiration to those who were fortunate enough to serve with him on the Council. The movement required men of vision and keen enthusiasm. These qualities, together with a high resolve and strong faith, he possessed in large measure.

In having such a gifted leader for the cause, the Society was indeed most fortunate. His wise counsel, his kindly, winsome and considerate disposition, and his courageous leadership, will be greatly missed. These are the qualities by which those who were privileged to know him will long remember him.—*Allan W. Ritchie, former President, Scottish Division.*

He was a gentle knight who rarely unsheathed his sword, believing in the *sauviter in modo* rather than the *fortiter in re*. But when he had occasion to enter the lists he fought valiantly for what he considered to be the right. By his death the Society has lost a leader whose devotion to the cause of smoke abatement was at once its strength and inspiration.—*Dr. J. Johnstone Jervis.*

Mr. Gandy's constant interest and enthusiasm have been an inspiration to us all in our efforts in the cause of smoke abatement, and his encouragement and leadership will be remembered for many years to come.—*F. J. Redstone.*

Margate

Some Sayings from the Platform

The Margate Conference was marked by being the occasion of the Society's coming-of-age, and by the inauguration of the Des Voeux Memorial Lectures. To Dr. D. T. A. Townend for his lecture "Towards the Better Use of Coal," the Society will always be grateful, for it would be difficult to conceive a more important or appropriate work to set the high standard that was desired and hoped for as the hall-mark of these lectures. It was fitting and gratifying too, especially for those who had known and worked with our first President, that Mrs. Des Voeux should have been present and should have moved the vote of thanks to Dr. Townend.

At the Annual General Meeting, preceding the Conference proper, the Presidential Address was read by Dame Vera Laughton Mathews, and was received with marked pleasure, both on account of its content and the charming, witty way in which it was spoken.

The other sessions were on "Smoke and Health," with two papers; "Smoke

Prevention as Applied to New Housing," with five papers; and "The Problem of Railway Smoke," with two papers. All will be published shortly, together with the Des Voeux Lecture and the Presidential Address, and the discussions, in the complete record of "The Proceedings of the Margate Conference, 1951." Copies will be sent to all who were registered as attending the conference, and to other members on request only. The price to others, and for additional copies, will be 6s. Dr. Townend's lecture will also be available as a separate reprint at 2s. 6d.

In parties of thirty, after each session, nearly all the 400 members and delegates visited the British Railways Instructional Train that had been brought specially to Margate for the occasion. On the social side the conference was privileged to be entertained by His Worship the Mayor of Margate (Councillor C. B. Hosking) at a Reception, while the "Coming-of-Age" was appropriately celebrated at an evening birthday party.

The Society

Soon there will be a Silver Jubilee to celebrate and I wish we could say that we do not want too many Jubilees after that; that the work the pioneers set out to do will have been accomplished. But I am afraid the full realization of their ideals is still a vision of the future and until that vision becomes a reality, so long will the National Smoke Abatement Society continue with the steady, determined and persistent work which has distinguished it in the past.—*The President.*

The Miner's Work

It was shocking enough in the days when the country was prosperous and coal was cheap and easy to come by, that 10 million tons a year should be wasted by just going into the air as smoke and soot and acid—shocking when one thinks how coal is obtained,

of the gruelling toil involved in that labour underground, work that none of us would care to spend our lives doing.—*Ibid.*

The Open Fire

It is even suggested that to do away with the open coal fire would strike a blow at British family life. Well, one does not see those roaring blazes in other countries and I refuse to believe that this country has a monopoly of happy marriages. Really, if the person in the armchair on the other side of the fireplace is not just what is wanted, the rosy fireglow is not going to make all that difference.—*Ibid.*

The Des Voeux Lectures

The right to be remembered with honour is one which is due to all pioneers and prophets, but one which is not in fact always accorded to them,



Dr. Townend reading the first Des Voeux Memorial Lecture

even posthumously. The decision of your Society in the year of its coming of age to establish these lectures in memory of your distinguished founder appears to me to have been an exceedingly happy one, and I am the 'more pleased, therefore, to have a part to play in this act of public remembrance.—
Dr. D. T. A. Townend.

The Scale of Coal Research

It was stated in the House of Commons, recently, that the total annual expenditure (on coal research) amounted to roughly £1 million, or 1½d. per ton of coal. Research in this country on oil amounts to at least £0.5 million per annum, corresponding to more than 7d. per ton, and coal research in France has been financed since October, 1948, by a levy of 12 fr. (3d.) per ton. When we remember other large-scale national expenditure, and having in mind that £1 million per annum is the approximate equivalent of the aggregate cost of one cigarette *every four months* per head of the adult population, this position, I think, calls for serious thought—particularly in

view of the importance of coal research in all its aspects to our present national economy.—*Ibid.*

No Minimum for Smoke

It is apparent that a smoke-laden atmosphere by its irritant action on the respiratory system is harmful to the community and may leave residual respiratory defects in those exposed to it whilst injuring still further those with previously impaired cardio-respiratory tracts. By virtue of the gross variation from person to person that exists in the threshold of resistance to such irritation it does not seem possible to establish a pollution intensity below which it could be said no harm would be done.—
Dr. J. S. G. Burnett.

The New Towns

While it has not been possible to embark upon comprehensive schemes for district heating or piped hot water in the New Towns so far designated, the detailed provisions which are being incorporated in the design of the industrial, commercial and domestic buildings should enable a New Town



At the Mayor's Reception: The President greets Mrs. Gandy and our late Chairman

to say with the well-known gentleman in the advertising pages of your journal, "Give up smoking? I never started!"
—*Mr. C. A. C. Turner.*

Criticism

The new appliances are proving themselves to be satisfactory, and gas coke, even if not the other smokeless fuels, is at last easy to obtain. Progress is indeed being made, yet many opportunities are being lost, new areas of smoke pollution are coming into being, and only a fraction of what could be done by local authorities to encourage smokelessness, is in fact being done.—*Mr. F. J. Redstone.*

The Steam Locomotive

The bulk of railway transport in this country continues to be handled by steam locomotives, and this will be the case, in all probability, for many years to come, provided that due attention is given to the economics of the problem for there is not the slightest doubt that the steam locomotive is the cheapest form of motive power we have. That being so, the author feels that efforts to reduce smoke will be well worth while, for although the use of Diesel locomotives may be extended, and

although additional urban railway systems may be electrified, it will hardly be possible to find the money for complete conversion to one or other of these costly alternatives.—*Mr. W. O. Skeat.*

Story with a Moral

A Superintendent of Motive Power on a British Railway noticed an engine standing and making undue smoke. He climbed into the cab, took the shovel from the fireman, removed half-a-dozen shovelfuls of coal from the tender and threw them over the side. The fireman looked on astonished. The superintendent then explained to the fireman that, by only partly burning the coal and sending the residue out by the chimney, he was just as truly wasting coal as if he threw it away and he was, moreover, creating a nuisance.—*Mr. M. G. Bennett.*

The Price of Fuel

Another way of encouraging manufacturers of smokeless fuel would be to remove the 9d. per gallon new Excise Duty on indigenous fuels. As far as my own Company is concerned, the removal of this Duty would mean a reduction in the price of "Coalite" of 5s. per ton. Speaking personally, I have heard that if the price of bituminous coal for domestic purposes was increased by 6d. per ton, it is possible that the price of reactive cokes might be reduced by anything up to 1s. 6d. per cwt.—*Mr. A. C. Hazel.*

Semi-Smokeless Zones—

The Coal Utilization Joint Council fears that if a general movement develops to establish smokeless zones throughout the country, there will be neither sufficient quantities of solid smokeless fuels nor of appliances capable of burning bituminous coal smokelessly. In the result, the smokeless zone movement might well be discredited. If the present supplies of solid smokeless fuels are to be used to the best advantage in the interest of smoke abatement, it will be better if certain of the new towns or re-development areas declare their intention of being "cleaner air" zones. A new

town can start clean, and it would seem right and proper to keep it so ; this can be done at little expense as the new houses can be equipped from the start with suitable appliances. In other areas, the C.U.J.C. suggest that local authorities should accept initially a less stringent standard than the absolute smokelessness required under the present Corporation Acts. An advancing programme, by which the better and cleaner appliances which are now available are widely installed, will secure an ever-increasing measure of smoke reduction over the country as a whole, which will be a much more practicable contribution to smoke abatement than the piecemeal introduction of a number of isolated smokeless zones with all their attendant difficulties of fuel supply.—*Mr. J. S. Williams.*

—And an Answer

One speaker has suggested that the problem is of such magnitude as to call for "moderation." Speaking for the coke side of the Gas Industry in my judgment there is nothing in the present or forward position that should occasion any moderation in the efforts of the Society. There are problems, of course, but many of the difficulties that have been mentioned are essentially matters of distribution. The Gas Industry has these well in hand.—*Mr. D. G. Rose.*

In the North West

The North Western Gas Board are spending £1,000 per week in advertising the use of coke and gas, and last year the Board sold 15,000 coke grates and anticipate selling considerably more in the current year. The grates are available on the hire purchase system at a charge of 7d. per week, including installation.—*Councillor C. E. P. Stott.*

The Housewife in the Mining Areas

I thoroughly approve the better conditions and modern machinery already being experienced by the miners, but I appeal to the officials of the National Coal Board to go further and install cleaning plants for the new coal and a more modern method of boiler stoking, so as to reduce the amount of

smoke and grime which belches forth from the colliery chimneys, thereby polluting the countryside. My final words are to the housewives to get together and try in some small way to clean up these dark spots of which our country has many.—*Councillor Mrs. I. Heppleston.*

Sulphur—

With regard to sulphur deposit it is estimated from the figures given by the British Electricity Authority alone that the four power stations in the Don Valley emit about 120 tons of sulphur dioxide per day with coal of a low sulphur content of 1.8 per cent. Iron-work corrodes rapidly, stonework shows signs of disintegration and vegetation becomes blighted in the path of these gases, yet the Authority will only try to palliate the nuisance by raising the height of the chimneys and hoping it will dissipate the sulphur. From the chemical works the emissions are so bad as to cause watering of the eyes and coughing when in the neigh-



The Mayor of Margate, Councillor C. B. Hosking, with the Hon. Treasurer

bourhood. A gauge at Bessemer Road, Sheffield, shows a daily average of 152.2 mgm. per 1,000 square cms. per day, or 14 times that of the residential areas during 1949.—*Mr. James Law.*

—And High Chimneys

Mr. Law disbelieves in the benefits of tall chimney stacks. Ten years of observations (published officially) on sulphur pollution round Battersea, the first two years with gas washing plant in action, the next six years with no gas washing, and the final two years with half the station on gas washing, have shown no significant difference. It may be pointed out that Battersea Power Station has tall chimneys.—*Dr. H. E. Crossley.*

The Smoke Inspector

Are we all satisfied that this job of cleaning up the air is being vigorously tackled in all areas? I suggest that the efficiency of smoke abatement work and the interest needed for preventing fresh sources of pollution are intimately bound up with the number of qualified smoke Inspectors available to local authorities. I ask that this point be more widely appreciated, and that the holding of special qualifications on this

subject, which mean time, effort, and expense on the part of the individual, should be suitably recognized.—*Mr. F. J. Redstone.*

Wedded to Raw Coal?

I also think that something should be done by the Railways to bring about the use of smokeless fuels in railway yards, offices and canteens. The Railways seem to be wedded to raw coal because they have to burn it in their locomotive fireboxes. If they would use gas or coke instead of these small fires there would be a great improvement in atmospheric conditions.—*Mr. P. H. Saunders.*

Improvement Classes

As an engine driver I appeal to Mr. Bennett in the matter of improvement classes. Cannot these with advantage be held in normal working time? It would be, I am sure, a source of great encouragement to younger men to be given the opportunity of attending these in other than their own time, as at present. I suggest that the Railway Executive would be making a real contribution to smoke abatement in giving facilities of this nature.—*Alderman A. P. Holden.*

Divisional Notes

The **North West** Division has been fully occupied with its part in the Fuel Efficiency Exhibition at Manchester. The Division shared a stand with headquarters, and a small sub-committee was responsible for the organization of the highly successful series of afternoon meetings and evening film shows which were held throughout the ten days of the exhibition. Many members also volunteered to assist in the staffing of the Society's stand.

The **East Midlands** Division held a successful meeting at Peterborough on October 19th, at which, in addition to business, papers were read by Dr. C. G. Crawshaw, Medical Officer of Health for the City of Peterborough, on the medical aspects of air pollution, and by Mr. J. Hall, Chief Sanitary Inspector

for the City, on the legal position. The next meeting will be held at Bolsover on April 19th, 1951.

The **Yorkshire** Council met in Sheffield on October 9th. A business meeting in the morning was followed in the afternoon by a tour of inspection of the pollution recording stations in the city, under the guidance of Mr. James Law.

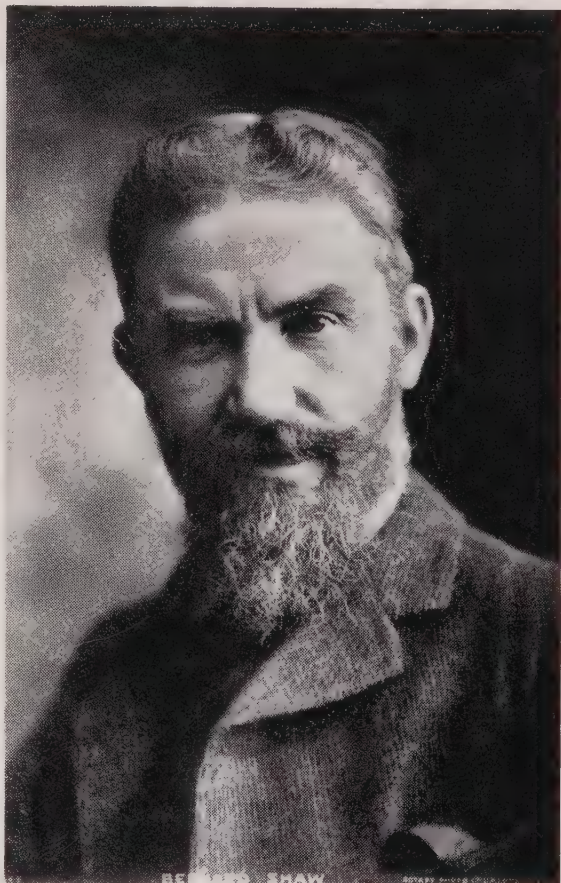
The **North East** Division also held an October meeting, and is at present considering a revision of its constitution. The new Tees-side Committee of the Division is actively investigating the local problems with which it is concerned. The new **West Midlands** Division has held a successful first meeting in conjunction with the Midlands Section of the Institute of Fuel.

SHAW ON SMOKE

(With some Thoughts on Genius)

The death of George Bernard Shaw prompts the re-publication of a speech he made at the annual meeting of the Coal Smoke Abatement Society in 1911. As far as we can gather from the records the financial situation of the Society was then extremely precarious, and some members were urging that it be wound up. Shaw was probably invited to the meeting by Dr. Des Voeux, whose friend he was, and the resolution he moved seems to have been, in effect, a motion of confidence in the Society and an encouragement for it to carry on. Not only is the speech genuine, vintage Shaw, but it contains much excellent, still pertinent, and quotable smoke abatement propaganda.

I PROPOSE the following resolution :
 " That this meeting, recognizing the harmful effects of coal smoke on life and property, pledges itself to support the efforts of the Coal Smoke Abatement Society in diminishing the evil." I would like to make a few remarks on the nature of genius. You might say that genius has nothing to do with smoke abatement and that it is not what you have come to listen to. But I know little about smoke, which is a common thing, and everything about genius. I am in that line myself. (*Laughter*). A man of genius is not a man who sees more than other men do. On the contrary, it is very often found that he is absent-minded and observes much less than other people. If you met a man of genius in Whitehall and asked him what had passed up that thoroughfare while he has been there you would probably find that he would be reduced to a condition of stuttering imbecility, but if you asked the nearest policeman, who might or might not be a man of genius, he would tell you a number of useful facts. This being so, what good is a man of genius ; where does he come in ? Why is it the public have such an exaggerated respect for him—after he is dead ? The reason is that the man of genius understands the importance of



Bernard Shaw, about 1911
(Picture Post Library)

the few things he sees. William Blake, whose genius is perhaps more beyond dispute than that of any other Englishman, saw a quite common thing, and wrote of it in language which you would probably describe as monstrously exaggerated. He writes, in his "Songs of Innocence," of a linnet in a cage which "puts all Heaven in a rage." An ordinary man would never have thought of that. The ordinary man only sees a linnet in a cage, and looks on Blake's lines as one of those absurd things which men of genius say. I rub this in because I myself am always being accused of exaggeration.

To the ordinary inefficient mind there is one thing which can be seen over and over again without any importance being attached to it, and

that is a smoking chimney. No importance used to be attached to it until there came along a man of genius who began bombarding the local authorities with spirited drawings representing smoking chimneys—and occasionally there were details on them as to how long they had been smoking. The artist was evidently representing something. Some members of the local authorities apparently concluded these sketches were intended for their portfolios, and began to collect them. But it began to be apparent that the man who did these drawings believed that it was extremely important for England that smoke should be put an end to. The man was Sir William Richmond. That was the beginning of the movement, and the extent to which it will progress will depend upon the number of men of genius in the community. If any of you present will send a cheque for five guineas to the treasurer he will to that extent prove that he is a man of genius. There is no use in expecting an ordinary person to do anything. The affairs of the world must be directed by men of genius. The few people who see these things will have to become centres of propaganda, and will have to back the movement up in every way they can. They must wake up the common man to things which he has hitherto taken as a matter of course.

Some time back Sir Almroth Wright delivered a scientific address in London containing a great deal of valuable matter. The Press took no notice of that valuable matter; but Sir Almroth having casually let fall a remark that he was rather sceptical of the value of washing, we read everywhere, "Distinguished physician says we should not wash ourselves." (*Laughter*). I sympathize with Sir Almroth Wright, because we are both fellow countrymen. One has to be an Irishman to understand the antipathy and instinctive dislike that every Irishman has to washing. Anyone going to Ireland will understand the feeling. (*Laughter*). The fact of the matter is that washing is not a natural function. Sir A. Wright has often remarked that some of his

patients remove a considerable portion of that skin which nature intended should ward off germs, and he has suggested that we should be careful to preserve that outer layer. But in a soft climate such as Ireland's it is very disagreeable to put cold water on the skin; and as for hot water, one has only to look at people who take hot baths to see that they are the only people who look incurably dirty. Personally, I do not think I have really washed myself—except as regards the visible portion of my body like my face and hands—since the time when somebody else did it for me. It is true I have got into the habit of taking a cold bath; but that is not washing. I do it as a stimulant, and I often think I had better have taken to whisky. (*Laughter*). When I first came to London one of the first things I noticed was that everybody wore gloves. Where I come from only a few wear them occasionally as a tribute to their superiority. But before I had been here many days I discovered that I must do so now. According to any decent standard everyone ought to be cleaner than they are.

The real secret of healthy cleanliness is to have a clean atmosphere and clean clothes, and until you get rid of smoke you can never have a clean atmosphere. (*Applause*). A clean atmosphere would probably prolong our lives and enable us to save money. We talk about the saving in coal by preventing smoke; but there would also be an enormous saving in soap. There is no doubt about the saving; in fact, if it were possible for a commercial company to realize that particular profit for themselves the whole place would be flooded with prospectuses of new joint-stock companies for coal smoke abatement. Unfortunately, it is not realizable as a commercial asset. All we can do is to rely on individuals and on public opinion. We should cut all those persons who have smoky chimneys. We should refuse their invitations to dinner, alleging as the reason: "I have seen black smoke proceeding from your kitchen chimney."

Coal smoke is not like original sin, a thing we are obliged to put up with.

It was said once that dust could not be done away with on our public roads. I myself have driven a motor-car amid the execrations of the populace. Now dust is almost abolished. If every motorist will now make it a point of honour to drive at a reckless speed in order to stir up any dust there is remaining, and will also make a point

of driving rapidly through a pool whenever he sees a Bishop near, these two pests, dust and mud, will soon become things of the past. And, with a similar object in view, I suggest that those who want to get rid of coal smoke should make a practice of carrying about a bag of soot and throwing it over people's collars and shirt fronts, in order to convince them of the evils of smoke. (*Laughter and applause*).

The Manchester Fuel Efficiency Exhibition

Although only this "stop press" note on the Exhibition, and the photograph below, can be included in this issue, it can be briefly stated that the show in every way came up to expectations, and in some ways well exceeded them. The official opening by Lord Hyndley was a pleasant and well-attended function, the daily lectures were well worth while, and the eighty exhibitors without exception appear to

be fully satisfied with the interest taken in their products or services. Visitors from all parts of the country attended, and we were glad to see so many members of the Society. Many tributes have been paid to the organizers, Provincial Exhibitions Ltd., and to the Society and its North West Divisional Council, under whose auspices the Exhibition was held.





Electrical Research

A Visit to Perivale

TO follow the articles in recent issues on gas research (Watson House) and coal research (B.C.U.R.A.), a visit has been made to the laboratories of the Electrical and Allied Industries Research Association at Perivale. It was a first journey to Perivale, which, a part of Greenford, lies to the west of London, between Ealing and Harrow, with the busy Western Avenue running through it. It seemed to be a town consisting almost entirely of modern factories, large and small, many of them displaying names made familiar in the shops and the advertisement columns of the newspapers. Beyond this tight-packed "vale" higher wooded ground helped one to visualise the vanished green countryside of some thirty years ago. In the last century the growth of so concentrated an area of manufactures would have meant a veritable forest of tall chimneys, each serving its

own small boiler house, and each emitting its own plume of smoke. As it is there is hardly a chimney to be seen—power, heat and lighting for the factories comes for the most part through the gas main and along the electric cable.

In a sense, therefore, it is appropriate that the Association—E.R.A. for short—should have its home at Perivale. It is intended, however, as soon as the buildings have been erected, to make room for the considerable expansion that is needed by moving to Leatherhead in Surrey, where the offices and main library are already situated. The Association will then have B.C.U.R.A. and other research associations as its immediate neighbours.

E.R.A. is a co-operative organization which was formed in 1920 as the successor of an Electrical Research Committee that had been set up in 1917

as a result of conversations between representatives of the industry and the newly-formed Department of Scientific and Industrial Research. The Association has grown steadily since then, and the extent of its activities today can most quickly be appreciated by the fact that its annual expenditure runs at around the £200,000 level, and that it has 23 standing research committees, most of which have from one or two to a dozen sub-committees or panels. The membership of these committees includes about a thousand technical experts from industry and government departments. The Association is governed by a Council on which are represented the Department of Scientific and Industrial Research, the British Electricity Authority, Manufacturers' Associations, the Electricity Area Boards the North of Scotland Hydro-Electric Board, the British Transport Commission, and the Institution of Electrical Engineers, together with ordinary, associate, and co-opted members.

The diversity of the work being done is impressive, especially as it is concerned mainly with the more fundamental problems facing the industry—such research as is required today on the design of appliances and equipment is carried out in the main by the manufacturers rather than by the Association. It is impossible here to summarize all the projects on hand, and one can only mention, very briefly, a few of the most outstanding.

From the special viewpoint of this journal, for example, it was interesting to find that one of the Committees is concerned with Wind Power Generation and that another Panel is working on the heat pump. Some of the work in progress on the heat pump was seen and described, and particularly interesting was the investigation on the sources of the heat to be extracted and upgraded by the heat pump. If, for instance, heat is being taken from the ground, such problems arise as what are the variations to be expected between one soil and another; what is the best depth to sink the heat intake unit; and how does the weather, time of day and of year, and varying moisture con-

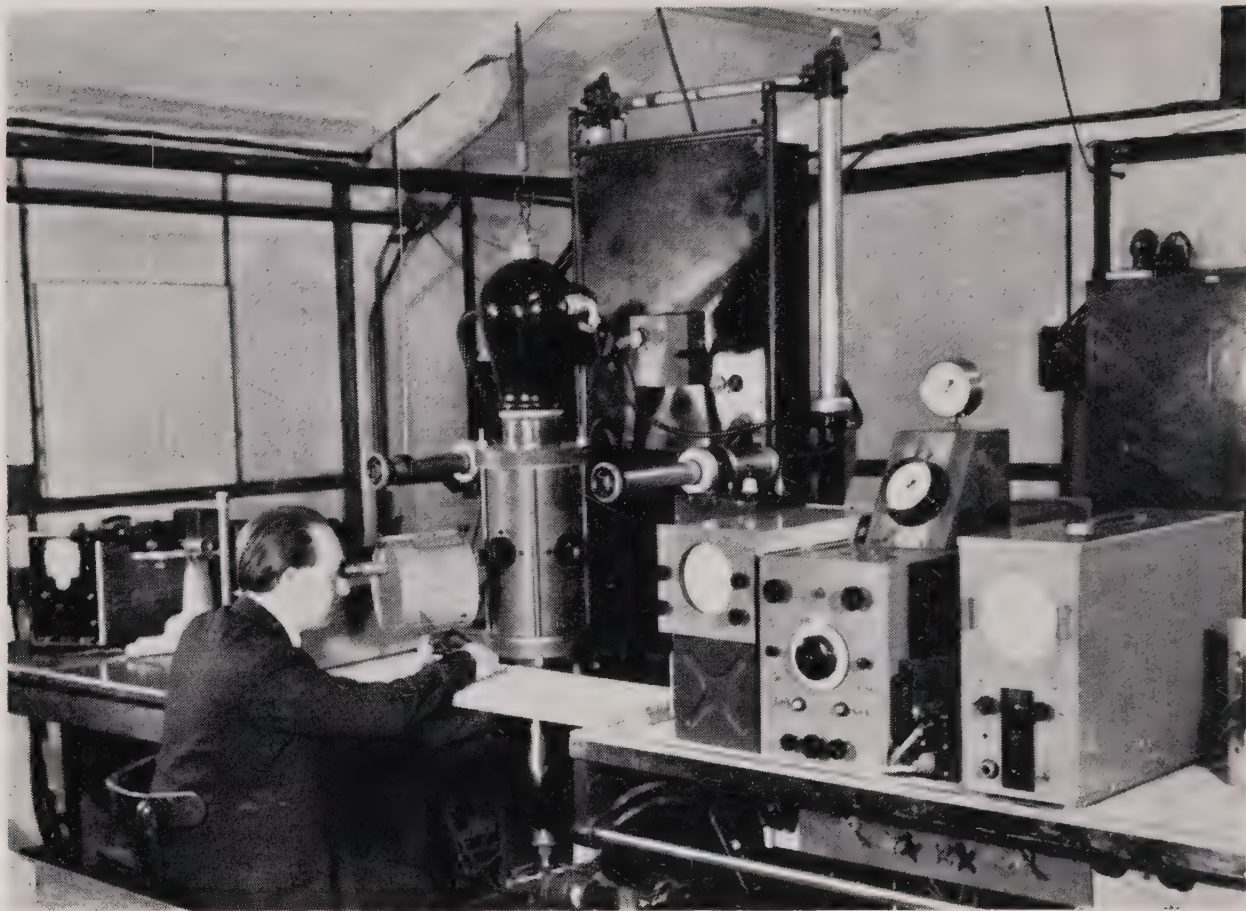


Cathode-ray oscillograph equipment in mobile laboratory

tent affect the operation? A heat pump unit is at present being designed and will be set up at the Association's branch station at Shinfield Green, in Berkshire, where problems of rural electrification and applications such as soil warming and crop drying are studied.

On the domestic side work is in progress on room heating, including investigation into the comparative efficiencies of different methods, such as radiant, convection, and panel. Electric floor heating is also being studied. Water heating is a further section, and research includes at present the layout of solid fuel-electric systems, and on increasing the efficiency of water heating by preventing the turbulent mixing of hot and incoming cold water in tanks. Scale formation in hot water systems is another factor being studied, and also of interest to the householder is work on the airing and drying of clothes.

Thus while much of the work relates to the use of electricity, other sections are concerned with generation and



Investigation of reignitions and transitions in electrical discharge of gases at the E.R.A. laboratories

transmission—overhead lines, insulation, earthing, and the important problems, little appreciated by the layman, of surge phenomena. A “surge” is a sudden rush of current or wave of voltage caused, for instance, by opening or closing a switch, or by lightning. Even the simple switch in our homes causes miniature surges, but the switchgear required for the very high power of the main transmission lines, at the other extreme, is a problem that has called for intensive research. The Association is proud of the part it has played in world-wide modern practice in power switching and circuit-breaking, and especially in the development of the air-blast principle.

At the beginning of the electric cable is the power station, with its problems in the boiler house and the turbines. Part of E.R.A.’s work is research to furnish data for the designing of steam and gas turbine by manufacturers, particularly on the properties of steam and the problems of creep and corrosion

of steel at high temperatures. Coal combustion problems are also dealt with to a certain extent, and some work is being done in conjunction with the B.C.U.R.A. Mention may be made of the development of a grindability test for assessing the relative ease of pulverizing coals, the development of small portable appliances for sampling dust in flue gases, and equipment for the routine testing of dust extraction plant—a problem of direct concern to many readers of this journal.

As one went round the laboratories, helpfully guided by the Association’s Information Officer, Mr. D. V. Onslow, meeting and talking to many members of the staff, it became apparent that not only was a great deal of important—and to an outsider fascinating—work being done, but that Dr. Whitehead, the Director, had gathered round him a remarkably fine team of men and women who were not merely experts in their particular fields, but who shared a common co-operative enthusiasm.

Smoke Prevention Trends in the U.S.A.

From a Paper by Louis C. McCabe

From among the numerous recent U.S.A. papers on smoke prevention we believe that this will be of particular interest to readers because of the clear and frank picture, from the inside, it gives of the American problem. It was read at the Air Pollution Symposium at Pasadena in November, 1949. The author has had wide experience in smoke prevention work, being the first Director of the Los Angeles County Smoke Control, and is now Chief of the Office of Air and Stream Pollution, Bureau of Mines, Washington.

IF we predict the future from the past, we can be assured that our attempts at air-pollution control will lead us in a circle. Should our past performance be repeated, we will emulate the farm boy who waits where the rabbit was flushed until the dog brings it around again to the starting point. I hope that this comparison does not correctly reflect the national trends in air-pollution control today. There is much evidence that it does not. However, if we are to know where we are going, we must recall where we have been.

Why have we generally failed in our efforts to control air pollution? There has been an incorrect estimate of the kind and size of the job, first of all. There has been far too small a concept of the problem by municipal officials; a few men are provided to staff an organization with duties comparable to keeping the streets clean, providing water supply, disposing of sewage, or furnishing police protection; small appropriations now and then are put at the disposal of the administrative officer; money has been uncertain in amount or has been denied in economy moves. After a few months of relaxation, the whole programme has vanished but not the atmospheric pollution.

We have failed because there has been great waste of effort and misguided enthusiasm on the part of the public when aroused to the importance of the

atmospheric pollution problem. Often there has been a lack of vision and unwillingness to pay the price or to allow the time that is necessary to obtain proper atmospheric pollution control. There must be a willingness on the part of citizens to wait for results. There must also be a willingness to pay for continuous long-time effort free from political control. Where these conditions are not found, there is only partial control or complete failure. There is no spectacular cure for atmospheric pollution, and no miracles can be performed. Long-continued and skilful effort is essential, if only to understand the nature of atmospheric pollution.

We have failed because industry believed that air-pollution control costs too much. Smoke and dusts were the wages of a prosperous industrial community, and the public generally shared this view or were forced by time and circumstance to accept it. There were "co-operative" programmes with the dual objectives of delay and defeat. Engineers were assigned to write diverting papers on the minutiae of the problem, and the trade journals editorialized on the unreasonableness of "do-gooders." These tactics haunt the sincere efforts of progressive industry today.

I have touched briefly on three reasons for failure in the past; there are a like number of reasons why we

should succeed in control of atmospheric pollution in the future.

In the ten years between 1937 and 1948, the gain in dollar value of industrial production in the United States exceeded 200 per cent. Manufacturing plants increased 39 per cent. and 52 per cent. more people were employed at the end than at the beginning of the period. Industry will continue to expand, and it is essential that it do so. Expansion means, in the simplest terms, that more air-borne wastes are produced and that in many communities objectionable levels of contamination are reached for the first time. When smoke, dust, and fumes are discharged into the air in an area faster than they are removed by natural cleansing forces, there is air pollution in that area. This is a compelling reason for something to be done about atmospheric pollution.

Control of atmospheric pollution as a duty appeals to less than a majority. Money saving in operation appeals to a few. The appeal to health is most potent, and it is for this reason that control of air pollution, though clearly an engineering matter, often is placed in the health department for administration. In general, the attempt to show a direct relationship between ill health and atmospheric pollution has been disappointing to those demanding exacting demonstration. The health considerations have been greatly strengthened by the Meuse Valley and the Donora disasters, which took the lives of sixty and twenty persons respectively.

Another reason for believing we shall succeed in our current efforts at control of atmospheric pollution concerns the activities of industry itself. Many conferences have been held within the year or are projected for studying ways and means of control.

Not only is there interchange of information, but there has been effective installation of equipment to control air contaminants. The petroleum, chemical, automotive, soap, metals, utility, and woodworking industries have some commendable accomplishments to their credit. Last month, I saw an effective method of controlling coal-mine refuse fires at one of the coal

mines of western Pennsylvania, a system of storing high-sulphur mine wastes, developed and continued at considerable expense.

There are significant developments in the equipment industry, notably in supersonics, the venturi scrubber, electrostatic precipitators, and filter collectors. Sulphur recovery from refinery gases, utilization of fly ash in making concrete, and recovery of waste heat are examples of improved operating techniques that are increasing. The coal industry has developed a smokeless domestic stove which is now in production and has effectively furthered the use of steam jets for smoke abatement in stationary and mobile steam equipment.

Folklore

I want to digress at this point and talk about one of the most human aspects of this subject, "folklore." It is far more colourful, extensive, and ramified than the engineering, medical, or meteorological phases of air pollution, yet they are the warp and woof of its fabric. It is harmless enough if it is recognized for what it is, but it can hamper serious work if it is not properly labelled.

There is current the statement that, "for a long time the onus for atmospheric pollution was put on smoke—more specifically coal smoke . . . (that) these theories have long since been exploded (and that) the idea that coal is the principal culprit is no longer seriously advanced . . ." The realization that fumes and dust cause serious atmospheric pollution is not new. Almost forty years ago, Aitkin described the rôle of sulphur dioxide in the formation of early morning fogs over the industrial cities of Great Britain, and he in 1880, and Owens in 1926, demonstrated the preponderantly greater amount of dust in city than in country air. The prevalence of smog in cities that do not burn coal in no way minimizes the smoke nuisance where it exists.

In a Washington release in October is the statement that "Smoke of itself is not a bad pollutant, except under

unusual atmospheric conditions . . . (and it) is objectionable principally because of psychological effect . . . ” Have we reached the state where we can gild refined gold or paint the lily ?

There are references to street dust and particles from rubber heels and automobile tyres in some recent discussions of atmospheric pollution. We must bear in mind that the kind of atmospheric pollution we are concerned with is a phenomenon most commonly associated with temperature inversion and low wind velocity and that the behaviour of coarse dusts is best explained by Stoke's Law.

At the American Medical Association's symposium on atmospheric pollution at Atlantic City in June, Dr. Kehoe stated the health problem in much the same way as the Surgeon General did in the Donora report. These we can accept as informed and responsible professional evaluations. Unfortunately, the interpretation of health statistics is not reserved to the competent and the responsible, so we find growing out of the same body of vital data a catastrophe folklore on the one hand and a superman folklore on the other. One medical authority predicts the deaths that will be caused in a city by air pollution a year in advance, and another explains that since Neanderthal man we have adapted ourselves to it. The claim is made that atmospheric pollution is the cause of respiratory cancer and a layman claims this is not true ; witness—St. Louis, which passed a smoke-abatement law in 1940, has twice as many deaths from respiratory cancer as Pittsburgh, which did not put its smoke-abatement law into operation until 1948. A city health officer states that the “ figures strongly suggest that death from tuberculosis is inversely proportionate to the pollution of the atmosphere,” and two fuel-trade journals reprint it in boldface type. So folklore grows, and the claims and counterclaims underscore the need for adequate information and objective interpretation.

Now we come to the folklore of the “ inexorable laws of nature.” Here are the volcanic dusts of Krakatoa, Mt.

Katmai, the African Savannas, pollen, spores, viruses, and bacteria. These are not pertinent to the discussion of localized man-made metropolitan air pollution. It is true that the weight of aerosols of natural origin in the earth's gaseous envelope is far greater than that from man's activities, but our concern is with the relatively long time that pollution of our own making remains in the little space in which we live. Knowing the tonnage of contaminants from all the stacks in Allegheny County, we should not use the volume of air in a mile column over the state of Pennsylvania in finding the solids per unit volume in this one country.

Temperature inversions are not air pollution, but I find this statement in an article on atmospheric pollution, “ Yet it's not air pollution alone that causes trouble. It's the fact that foul air is sometimes held over an area for long periods, instead of being dispersed by the wind.” The “ inexorable laws of nature ” should be understood and used to guide our activities. A plane's fall is not the fault of gravity but of structural or human failure.

The administration of an atmospheric pollution law is difficult, and passing punitive law is no solution to the problem. In general, I favour a broad enabling act for the enforcement agency, such as Chapter 20 of the Health and Safety Code of California (1947). This permits realistic development of standards adaptable to local conditions, provides for effective enforcement, and assures due process.

In recent years, one of our engineering societies has been working on a so-called model smoke ordinance. This is a waste of effort because detailed specifications or standards cannot be written that are applicable to one or all aspects of a local problem. Efforts of this nature result in ineffective compromise or complete disagreement. Local conditions, concentration, and kind of industry require severe regulation in some instances, while others require less stringent regulations. There is always the danger that local promulgation or regulations will be hampered

by political or industrial influence, but this same influence can also be applied to defeat the standards laid down at any level.

Once the air-pollution-control district is established, good administrative ability is needed to guide it; cities rarely find or pay for the kind of services needed, yet an underpaid administrator is a luxury that no city can afford. A good engineering service is expensive but it is essential. Engineering services are now available from research foundations, universities, government agencies, and consulting-engineering organizations. Many cities may find it advisable to call upon these services to make the initial survey and to advise them constantly during the active conduct of their air-pollution programme.

The Human Problem

Enforcement is technical on the one hand, the intensely human on the other. As far as its technical phase goes, the solution can be found; the most difficult part is the human problem. One of its strange aspects is that no polluter is troubled by his own pollution. We are all quite willing to have our neighbours regulated; the difficulty comes in being regulated ourselves. There always is and there always will be opposition. There are always people who say that it will injure business. Without arguing about it, look at the result where some success has been achieved. In almost every case, once the objectors have put their own house in order they support the programme. Usually the cost is not as much as they had feared.

Science and engineering are generally keeping pace with air-pollution problems. The results of war and postwar research in meteorology and aerosols can be used to advantage now. The scientist or the engineer familiar with such problems must be brought in to assist and plan proper control. The initial survey must determine the cause of pollution, where it is produced, and what proportion it bears to the total. A successful programme requires work of all forces. There must be a citizens'

committee. The Chamber of Commerce must help. The engineering societies of the community should participate, and it is essential that constructive information be given the public by newspapers, radio and television.

The elements of a successful programme are, first, an aroused public support, and this cannot be a minority. Second, there must be vision. Gifted people and disinterested people must look at this problem twenty or thirty years ahead, for atmospheric pollution is cured only in decadence or death of a community. It is a problem that is always with us. The citizens committee must be a godfather to enforcement in operating the air-pollution organization. It should be neither paid nor should it have political connections. Third, there must be continuous effort, otherwise we come back around the circle to frustration and failure. This does not mean the end of air-pollution programmes, however. Fourth, is a sound enabling act. As has been pointed out, this should be broad in scope and should make no attempt to set up detailed rules and regulations. Fifth, technical skill must be available through consultants or through the staff of the enforcement agency itself. Technical ability must be employed by industry to avoid undue cost and unnecessary mistakes. The enabling act previously referred to should provide for large units of enforcement, comparable in size to the industrial area to be served. It should have rule-making authority, or should delegate that authority to the director subject to the review of a hearing board. The hearing board should be composed of outstanding citizens of the community and should not be too large. Three men are adequate. Legal and engineering competence should be characteristic of this board. The district should be divided into an inspection division and an engineering division. As a rule, this will suffice, as it provides for all the activities that the district is commonly called upon to perform. The inspectors must be competent to give sound technical

advice of a constructive nature. Their purpose is not punishment.

Litigation over air pollution is increasing in the United States. In the Pacific Northwest, there are suits totalling two and one-half million dollars over alleged damage to crops by flourine. Suits totalling two million dollars have been filed as a result of the Donora episode. Crop-damage suits and payments in the Los Angeles area have reached many thousands of dollars where sulphur dioxide is involved.

The general prevalence of atmospheric pollution over our large cities is readily seen from the air, particularly in the early morning hours and during the fall and winter months. Delayed flights, late schedules, and lost time for equipment and crews are tangible effects experienced by many commercial air lines. An investigation of this problem is provided in House Resolu-

tion 6352. This bill "to authorize and direct the Civil Aeronautics Board to study the need for smog control in the vicinity of airports in order to promote safety in air navigation," was introduced by Congressman Cecil R. King of Los Angeles in the first session of the 81st Congress and referred to the Committee on Interstate and Foreign Commerce.

The Acropolis is Crumbling

The Acropolis of Athens is slowly crumbling away because the acid-producing sulphur dioxide polluting today's air is disintegrating its marble, Dr. A. J. Sofianopoulos of the University of Dayton told the American Chemical Society. The remedy is periodic washing with pure water. Previous centuries of pure air left Athens' marble monuments relatively untouched.



Learning about Smoke.—A pleasing picture of interested pupils from the Girls' High School being told about the measurement of air pollution by Mr. G. A. Lidster, Borough Meteorologist, in Hesketh Park, Southport. Local Authority members please note—education is a key to smoke prevention. (Photo by courtesy of the *Southport Guardian*)

Low Temperature Carbonization

The "Coalite" Process

In view of the many questions asked about the different solid smokeless fuels we are publishing a series of contributed surveys in which the history, production, properties and future outlook of the fuels will be described. The next article will deal with Gas Coke.

How it All Began

In the first year or two of this century the appalling smoke and thick fogs in London were causing the gravest concern. The health of the citizens was being seriously affected, and the damage done to buildings was amounting to hundreds of thousands of pounds. About the year 1903 a group in the City decided that something must be done to reduce the evils of smoke and fog, and they approached Thomas Parker, a brilliant engineer of the time, who had been responsible, amongst many other things, for the electrification of the Metropolitan Railway. Thomas Parker was already interested in this national problem of reducing the smoke nuisance, and had been granted the first medal of the Smoke Abatement Society for his "Kyrle" grate in which bituminous coal could be burnt smokelessly by making the fire consume its own smoke, an idea which has recently been revived.

Parker got to work, assisted by his son, Mr. C. H. Parker, J.P., F.C.S., a Director of the present Company. Mr. Thomas Parker carried out numerous experiments and finally in 1905 demonstrated that bituminous coal could be successfully carbonized at a low temperature, and that the smokeless fuel produced was easily ignited, gave out a great heat and burnt with a cheerful flame. He took out the basic patent in 1906.

The Process

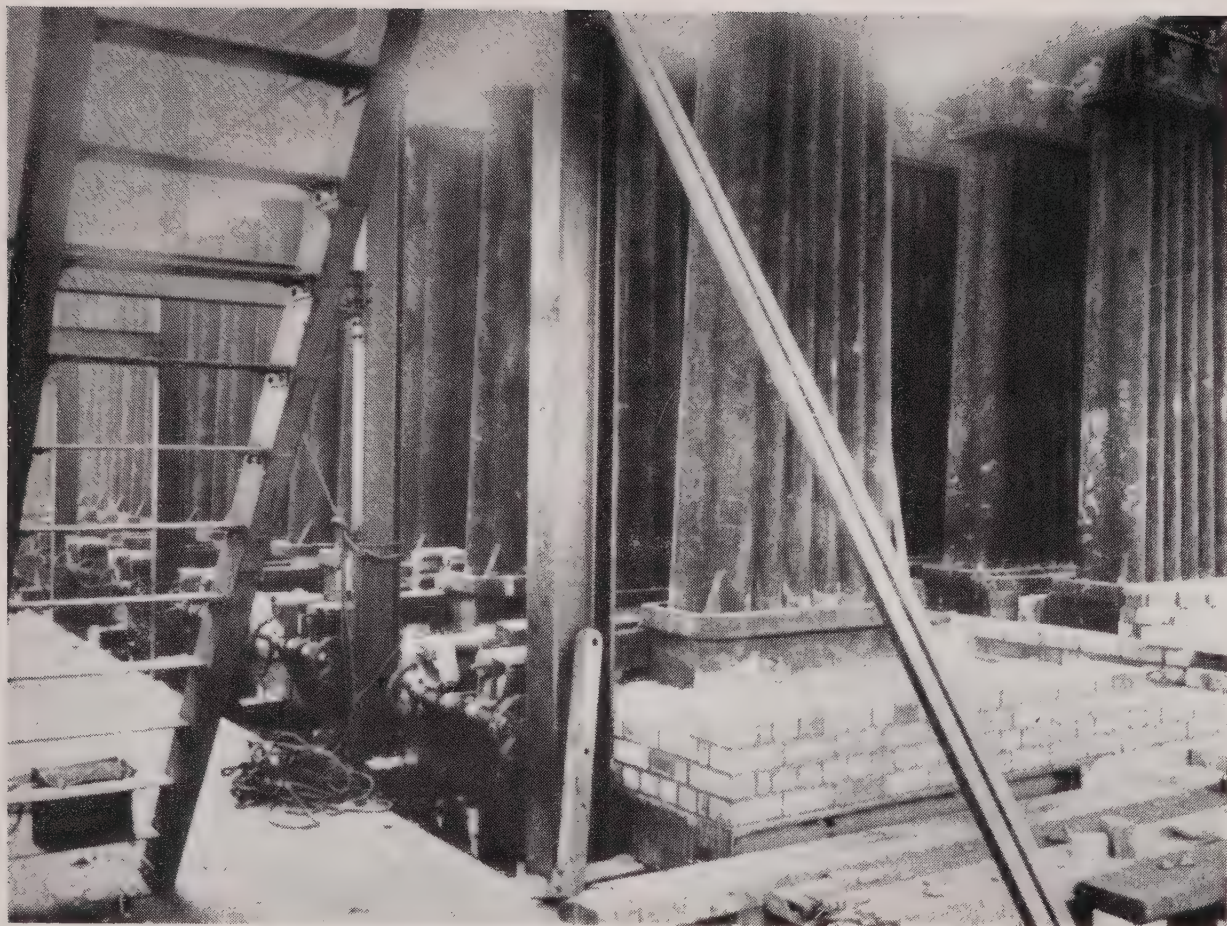
The carbonization of coal produces coke, which will vary in quality and

characteristics according to the coal treated and the temperatures employed. With high temperatures in the region of 1200-1400°C. the resultant coke will have a low volatile content of, say, less than 1 per cent., whilst with a temperature of 600°C. and a suitably designed retort, the residual fuel will consist of free burning semi-coke of the "Coalite" type with a volatile content of about 10 per cent. The following table shows the comparative yields from one ton of coal for the two methods :

Product	High Temperature Process	Low Temperature Process
Gas	11,600 cu. ft.	4,000 cu. ft.
Tar or Coal Oil	5 gallons	17 gallons
Benzole or		
Crude Petrol	2½ gallons	3 gallons
Coke	13½ cwts.	Nil.
"Coalite"	Nil	15 cwts.

It will thus be seen that the high temperature ovens produce more gas and less oil. The "Coalite" process produces more oil and less gas together with a smokeless solid fuel of superlative quality, easy to ignite, and which burns with a high efficiency of radiation and cheerful appearance in any type of grate.

Briefly, the process is one of heating coal in a manner which will drive off all the smoke-forming elements, and leave behind a smokeless coal of uniform quality which, though in appearance similar to certain cokes, has all the characteristics of a high-class house coal. Only the best washed and graded coals are used as the raw material for the production of "Coalite." Special care



“Coalite” retorts in course of erection

is taken to ensure that the coals selected are not in any way contaminated with any foreign matter which might affect the quality of the resultant “Coalite.” Where it is not possible to obtain a properly balanced coal from all points of view, several coals are mixed or blended to obtain the balanced mixture necessary to produce “Coalite” of the required standard of quality. It is by no means uncommon for four different coals to be blended or mixed in this way, which necessitates expensive plant comprising of wagon tipplers, conveyors, blending bunkers, crushing plant, etc. When the necessary mixture of coal has been obtained, it is charged in to the retorts and the carbonization process begins.

The “Coalite” retort consists of a special iron casting designed to produce the maximum amount of large-sized pieces and the minimum percentage of breeze, whilst at the same time ensuring that the coal oils recovered during the

process are low in ash and in free carbon.

The retorts are heated by gas, retorts and combustion chambers being arranged alternately throughout the setting, so that each retort is located in a radiation chamber formed by the walls of the two adjacent combustion chambers. With this design the retorts are heated by radiation only so as to give a consistent product and avoid over-heating, the carbonizing temperature being 600°C.

To ensure that “Coalite” has the required burning properties, it is necessary that the period and temperature of carbonizing should be most carefully controlled. To over-carbonize would result in a fuel that would be difficult to ignite and would not burn with the same ease and cheerfulness which is so characteristic of “Coalite.” To under-carbonize would result in smoke. The retorts are charged and discharged to a strict time-table, the

same retort being charged and discharged at the same times every day, week after week and year after year. The temperature is carefully controlled between narrow limits, both at the top, bottom, back and front of the retort. The setting of each retort is fitted with two pyrometers and the temperature is kept under observation by a responsible attendant during the whole of the carbonizing period.

The Main Product

The main product is "Coalite" smokeless coal. The whole purpose of Low Temperature Carbonization is the production of this superlative smokeless coal.

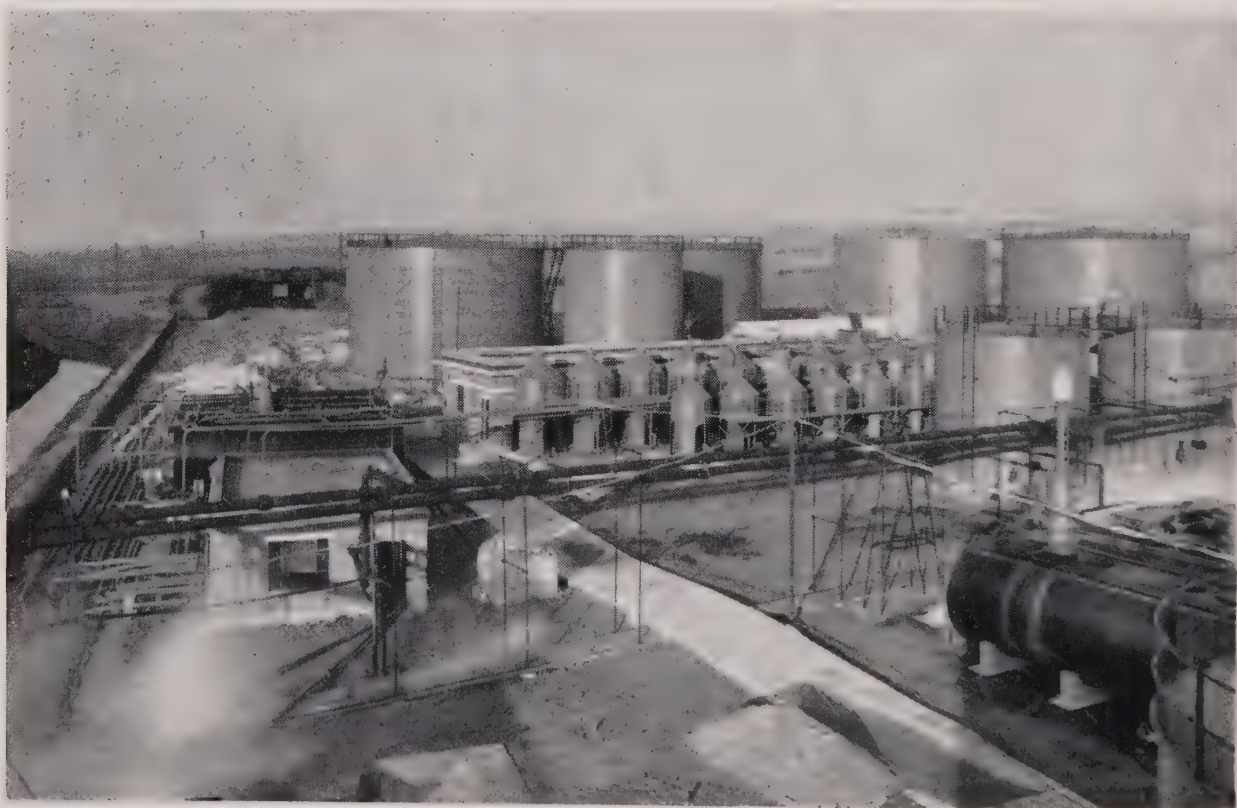
"Coalite" consists of approximately 83 per cent. carbon, 10 per cent. volatile matter and 7 per cent. ash. It is suitable for any type of grate and is magnificent in the open fire; owing to its high reactivity it ignites much more quickly than either raw coal or gas coke, and is extremely flexible to control.

It is absolutely smokeless and chimneys will carry on efficiently for years

without having to be swept. Rooms, curtains, carpets, furniture, ceilings, etc., remain clean for a much longer period and housework is reduced. It is clean to handle and can be stored anywhere. Fires made with "Coalite" never crackle or splutter, no bits or pieces are shot out (and there is no clinker).

One of its most important advantages is the fact that it can be used in a very economical manner. It is only half the weight of coal, bulk for bulk, thus the users get twice as many scuttles to the ton. As the fuel has a very high radiation efficiency and is bought by weight and used very largely by volume, its economy is easily accounted for.

"Coalite" does not vary in quality and can always be relied upon to maintain the high standard that it has established. The fuel owes its brilliant burning properties not only to its special composition but also to its structure, which enables it to combine readily with the oxygen in the air. Exactly the right porosity characteristic is imparted giving it a very high surface reactivity.



General view of oil washing plant, showing washers, separators and storage tanks

The By-Products

The liquid products obtained from coal by the "Coalite" process of low temperature carbonization are very different in quantity and nature to those derived from coal treated in any of the various types of high temperature ovens.

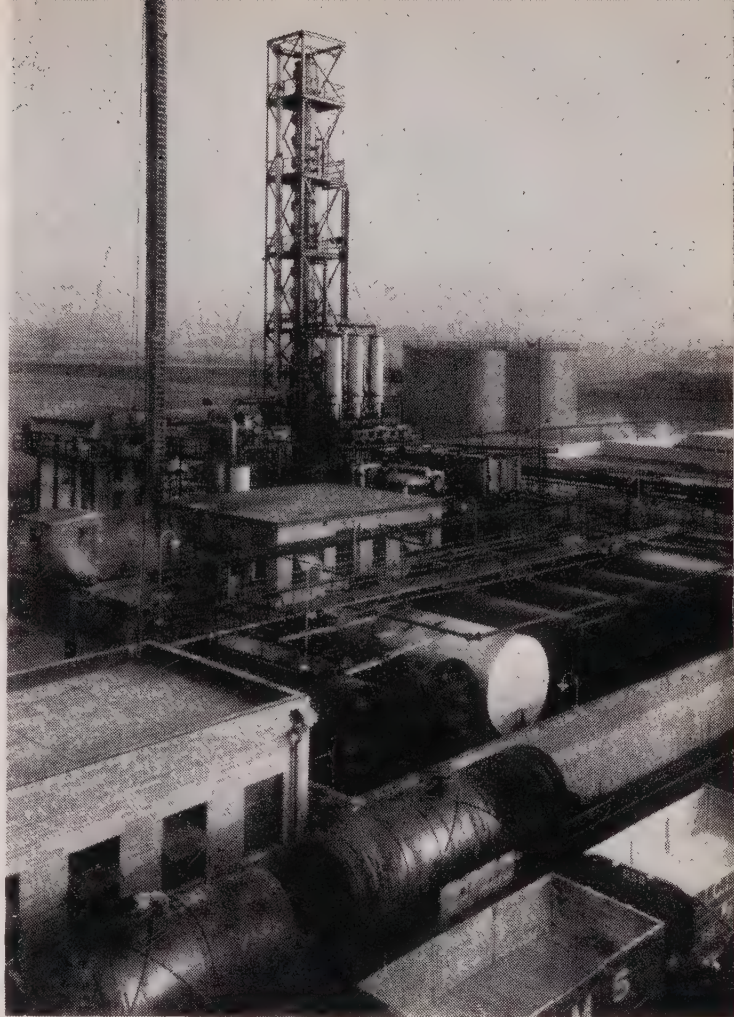
The total amount of tar obtained by the low temperature process is 17 to 18 gallons per ton of coal. When distilled at the Company's refinery at Bolsover, near Chesterfield, approximately $13\frac{1}{2}$ gallons of crude oil are obtained, leaving a little under 4 gallons of a new and valuable kind of pitch.

In 100 gallons of "Coalite" dehydrated tar there are 29.20 gallons of tar acids or almost exactly five times as much as from the same quantity of high temperature tar. As the amount of tar produced from a ton of coal is about twice as much at low temperatures, it follows that the amount of the tar acids recovered per ton of coal is about nine to ten times as much.

In other words, there can be produced from 100 tons of coal submitted to low temperature carbonization as much of the valuable phenols and cresols as could be obtained from 900-1,000 tons of coal treated by high temperature carbonization.

In addition to the crude tar, there are obtained about $3\frac{1}{2}$ gallons of crude petrol per ton of coal, and amongst the more important derivatives now marketed are: petrol, diesel oil, Lotemsol, creosote, cresylic creosote, Florastic (a special type of material for working into coloured mastic floorings and tiles), and phenols.

The phenol and meta cresol are used in the plastics industry and about 20 per cent. of the phenol is also used for medicinal preparations and other purposes. The cresylic acid is specially suitable for plastics and large quantities of this fraction have been and are being exported to the U.S.A. Large quantities of other fractions go to the disinfectant industry and for the manufacture of agricultural insecticides both for home and export, and the germicidal value of these low temperature acids is very high. They are also the basis of a



Section of coal-oil refinery at Bolsover

flotation medium for use in mineral separation.

Amongst many other products are Prenene "H", a rubber extender; various chlorinated materials for the manufacture of antiseptics and selective weed killers; Lotemcide, a potato haulm destroyer and non-selective weed killer; and numerous fine chemicals used in the production of adhesives, propellants and in medicine.

The Future

The production of "Coalite" is steadily increasing. In the past 15 months, the production of "Coalite" has increased by no less than 18 per cent.

The low temperature carbonization process gives the following advantages:

- (a) The process converts small coal into large domestic fuel.
- (b) Cutting, with the attendant and unavoidable excessive production of breeze, is unnecessary.
- (c) The process produces a very small percentage of breeze.
- (d) The process is practically self-

supporting as regards gas, so there is no problem of gas disposal.

- (e) The fuel is suitable for the open grate and for every type of domestic solid fuel appliance.

Work has commenced on long term schemes of reconstruction and modernization and this will ultimately result in progressively increasing rates of annual production. Increasing production to the limit of availability of suitable coal supplies does not present any technical problem. Indeed, it is claimed that the low temperature carbonization industry has reached a high standard of technical efficiency. The only problem is an economic one, e.g., the cost of the small coal used as the raw material for the industry as compared with the selling price of domestic house coal.

However, until the National Coal Board have completed their work on

the preparation of a price structure, it is not possible to give an estimate of the contribution that the low temperature carbonization industry can make towards the solution of the long term problem.

There is undoubtedly a case for the provision of the necessary incentives to encourage the increased production of solid smokeless fuels from the low temperature carbonization process to the maximum practicable extent.

From small beginnings this comparatively new industry is expanding far beyond the dreams of the early pioneers. In so doing, it is helping to solve the smoke and fog problem, at the same time providing the householder with an excellent all-purpose smokeless fuel and making available numerous valuable by-products to industry.

Smoke Prevention Abstracts

161. New Filter Material. (Science News Letter, Washington, D.C., Apr., 1950). Developed primarily to remove radioactive particles from waste gases escaping in processes in which such particles are made or used, but said to be applicable for filtering smoke stack gases and for filtering ventilating air for biological laboratories, operating theatres, etc. The material, developed by Arthur D. Little, Inc., under contract with the Atomic Energy Commission, is a paper-like product containing paper-making fibres in combination with finely divided mineral asbestos fibres. It is formed into soft flexible sheets which can be pleated and formed into shapes to fit filtering units of large capacity. It is relatively inexpensive and can be made on suitable paper-making machines.

162. Health Costs of Urban Air Pollution. Mills, C. A. and Mills-Porter, M. (Occupational Med., 1948, 5, 614-633). Using sootfall data as a measure of the local level of air pollution in various districts of Chicago, Detroit, Pittsburgh, Cincinnati, Atlanta and Nashville, a significant relationship is found between air pollution and the

death-rates for pneumonia, pulmonary tuberculosis and respiratory tract cancer. The rise in these death-rates is observed to be much sharper for males than for females, and it is suggested that tobacco-smoking may be connected with this.

163. Natural Removal of Pollution from the Atmosphere, Meetham, A. R. (J. Roy. Met. Soc., Oct., 1950, 76, 359-371). Observations of atmospheric pollution throughout Britain are considered in relation to the amounts of pollution emitted through the combustion of coal. The estimated weight of ash emitted into the air and the estimate, from deposit gauges, of the ash deposited, are considered likely to agree fairly well at a figure of rather over one million tons per year. On the assumption that about 1.5 million tons of smoke are blown to sea each year, it is shown that about 1.1 million tons of sulphur dioxide are blown to sea each year; the remaining 0.8 million tons of smoke and 3.9 million tons of sulphur dioxide must be deposited in Britain, irrespective of the quantities measured in deposit gauges. The average life of a smoke particle before deposition on land is probably of the

order of 1.2 days ; that of a molecule of sulphur dioxide is estimated with rather more certainty to be less than 12 hours. Of the chlorides collected in deposit gauges more than half, as a rule, come from the sea, and less than half from the utilization of coal ; but the ratio must vary with the position of the deposit gauges relative to the sea and to industries.

164. Catalytic Fume Incinerator (Indust. Equip. News, New York, Sept., 1950). The incinerator is installed in the exhaust flue from wire-enamelling, etc., oven. Burnable fumes such as naphtha, xylols, cresylic acid, are completely oxidized by the catalytic medium, which is arranged in the form of a cylinder through which the fumes must pass. Action depends on low temperature combustion accompanied by an abrupt rise in temperature between the entry and discharge sides of the element. (Catalytic Combustion Corp., Detroit, Mich.).

165. Smoky (Down Draught) Chimneys, Building Research Station. (H.M.S.O., 1950, Build. Res. Stn. Dig. 18, 4pp., 2d.). Recommendations are made for the design of chimneys to prevent down-draught smoking.

166. Environmental Health and the Ageing Population, Pond, M. A. (Amer. J. Public Health, Jan., 1950, 40 27-33 ; abstr. Industr. Hyg. Dig., Apl., 1950, 14 (4), 37). The increase in the average span of life has introduced a number of problems concerning environment in relation to ageing people. Among those discussed are housing, environmental cancer, accidents, and care of the chronically ill, but atmospheric pollution is one of the most important. In the Donora disaster and in the severe fog at about the same time, practically all the increase in sickness and death occurred in persons over 45 ; at Donora all the fatalities occurred to persons over 52, with an average of 65 years of age. This and similar experiences bring up the question whether older people are much more sensitive to atmospheric conditions ; also, what specific air contaminants are most significant.

167. Smokeless Zones (Hansard, Sept. 19th, 1950). Mr. F. Longden (Birmingham, Small Heath) raised the subject of smoke abatement on the Adjournment. He was supported by Dr. Barnett Stross (Stoke, Central) and Mr. A. E. Davies (Stoke, North). Mr. A. Blenkinsop, Parl. Secretary, Min. of Health, replying, said they were watching with interest the development in those areas where smokeless zones had been approved in Private Bills to see whether this was something which they could consider for general application.

168. Smokeless Fuels in L. A. Houses (Hansard, Dec. 7th, 1950). Mr. Janner asked whether the use of smokeless fuels should be made a condition of tenancy in council houses where this was reasonable, and what the extra cost to the tenant would be. The Minister of Health stated that he could not impose conditions of tenancy on local authority houses—that was reserved for the authority itself. In general, he said, there should not be any extra cost for the same amount of useful heat. The price of solid smokeless fuel was higher than that of coal but so was its thermal efficiency.

News Deferred

Space limitations and the time factor prevent the inclusion of much "late news" of interest, including references to recent broadcasts on smoke prevention by Dr. Monkhouse of the Fuel Research Station and Dr. Burnett, M.O.H. of Preston, and to Dr. Parker's lecture to the Royal Society of Arts on "Cities Without Smoke." These will be reported in the next issue, together with a review of the Manchester Fuel Efficiency Exhibition. Among books and reports waiting to be reviewed is an interesting survey "Smoke over Workington," being the very creditable work of the 2nd Year VI Form of Workington Grammar School. It is also hoped to include an account of a promising new form of smoke abatement organization—the local advisory committees set up in the boroughs of Widnes, Burnley and St. Helens.



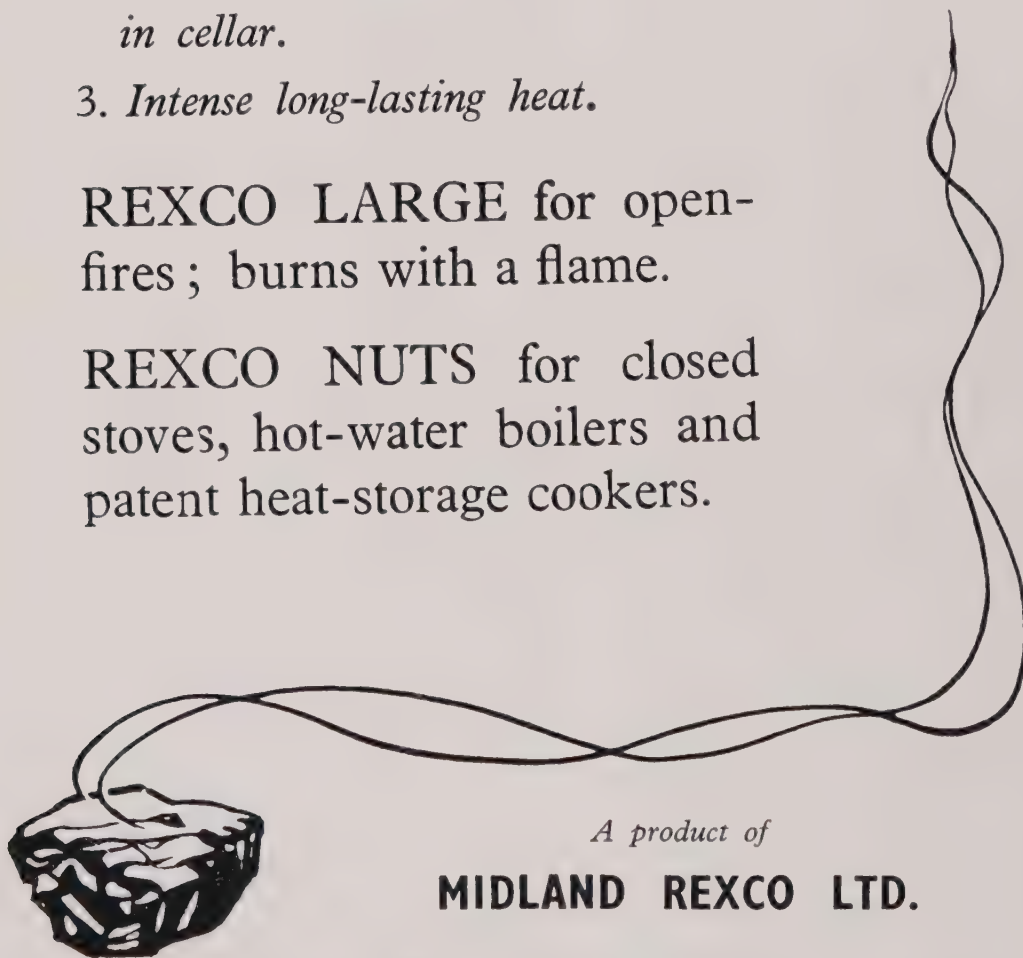
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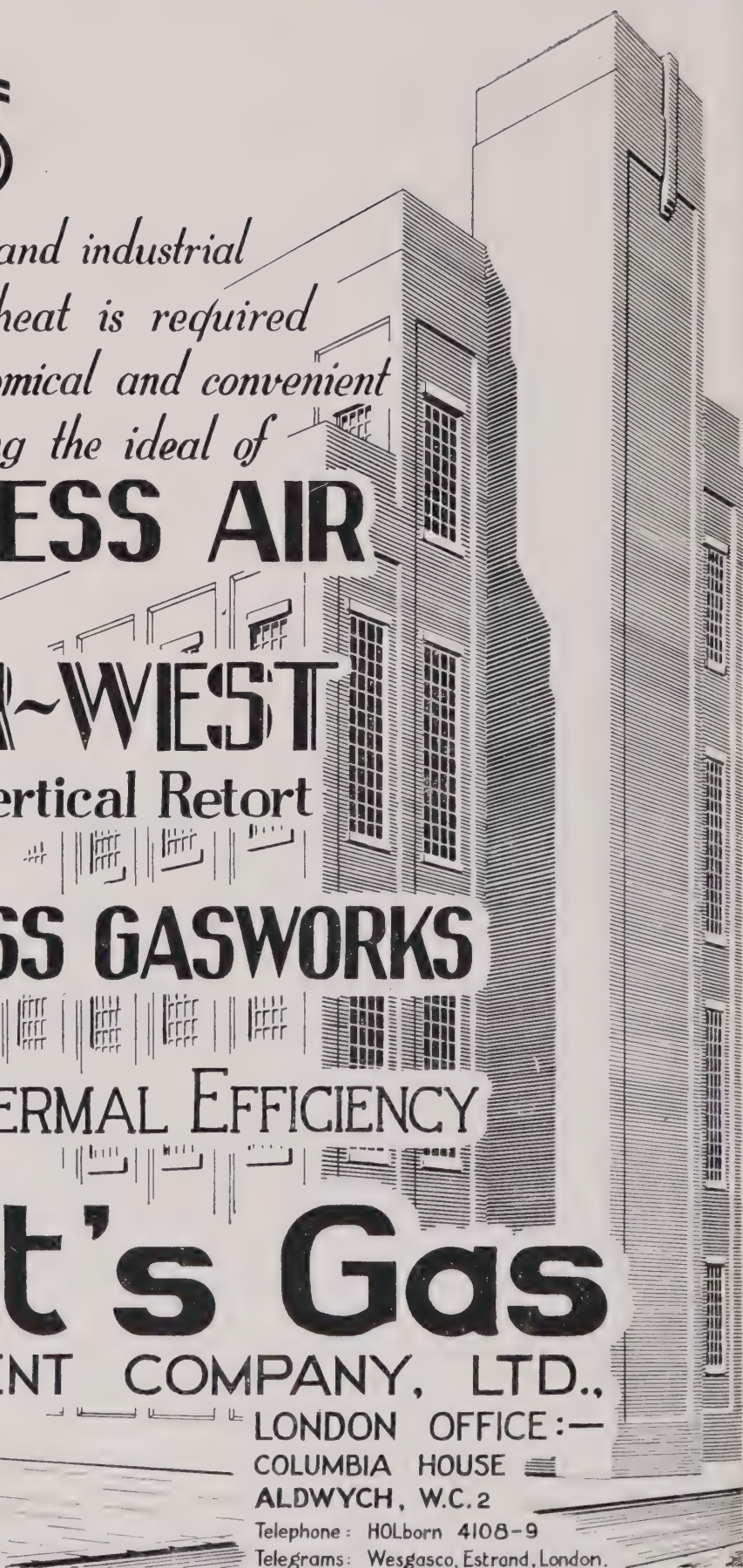
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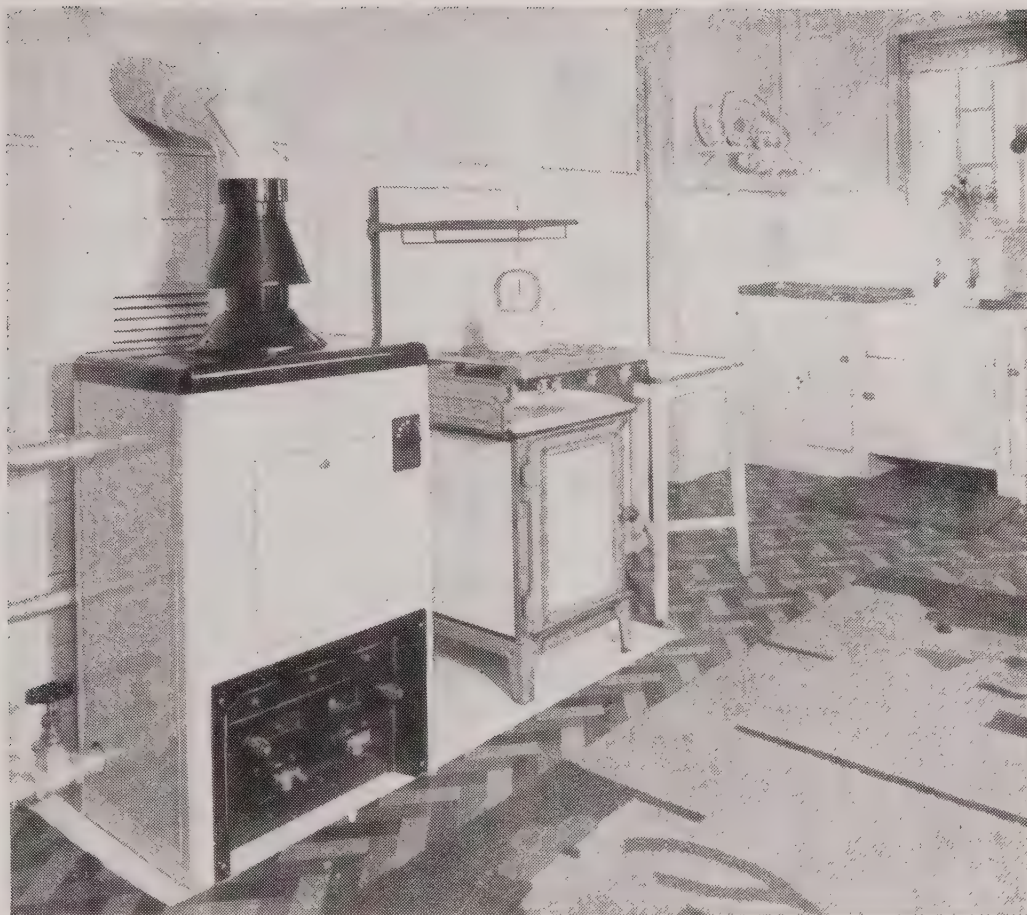
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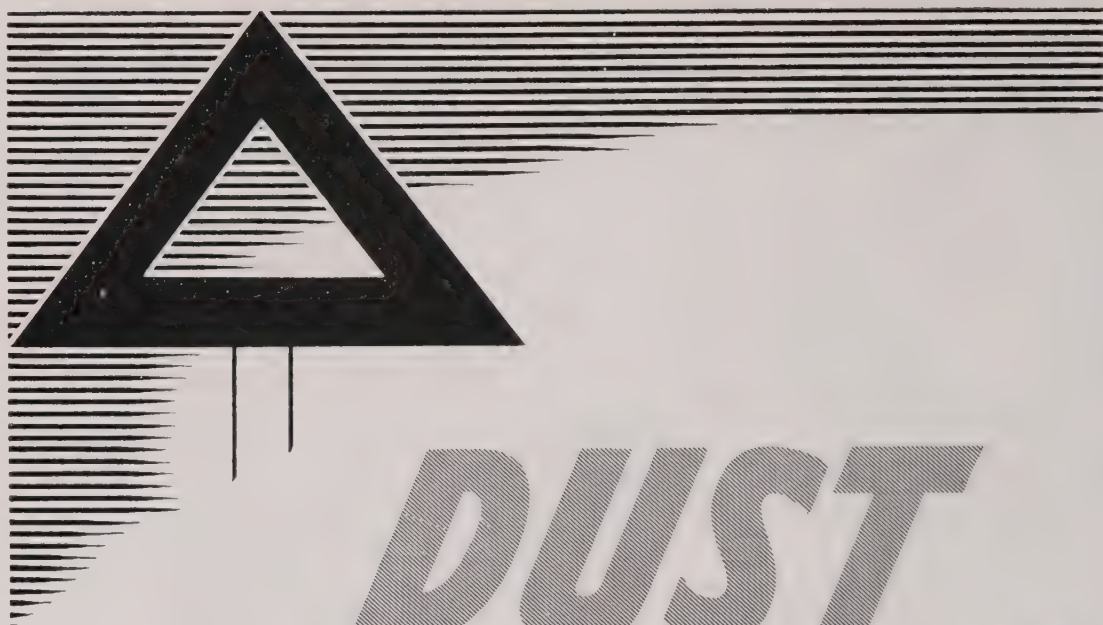
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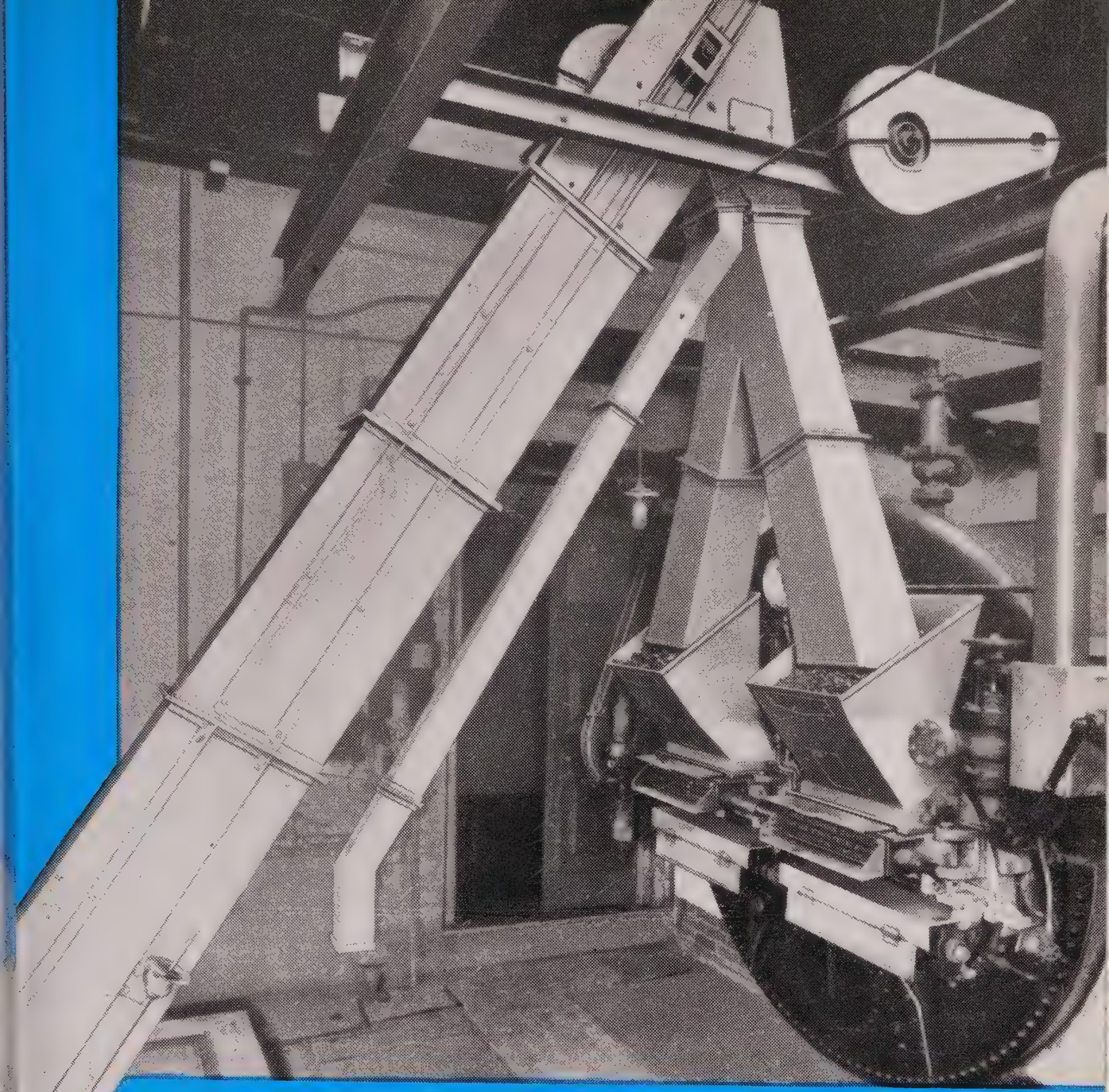
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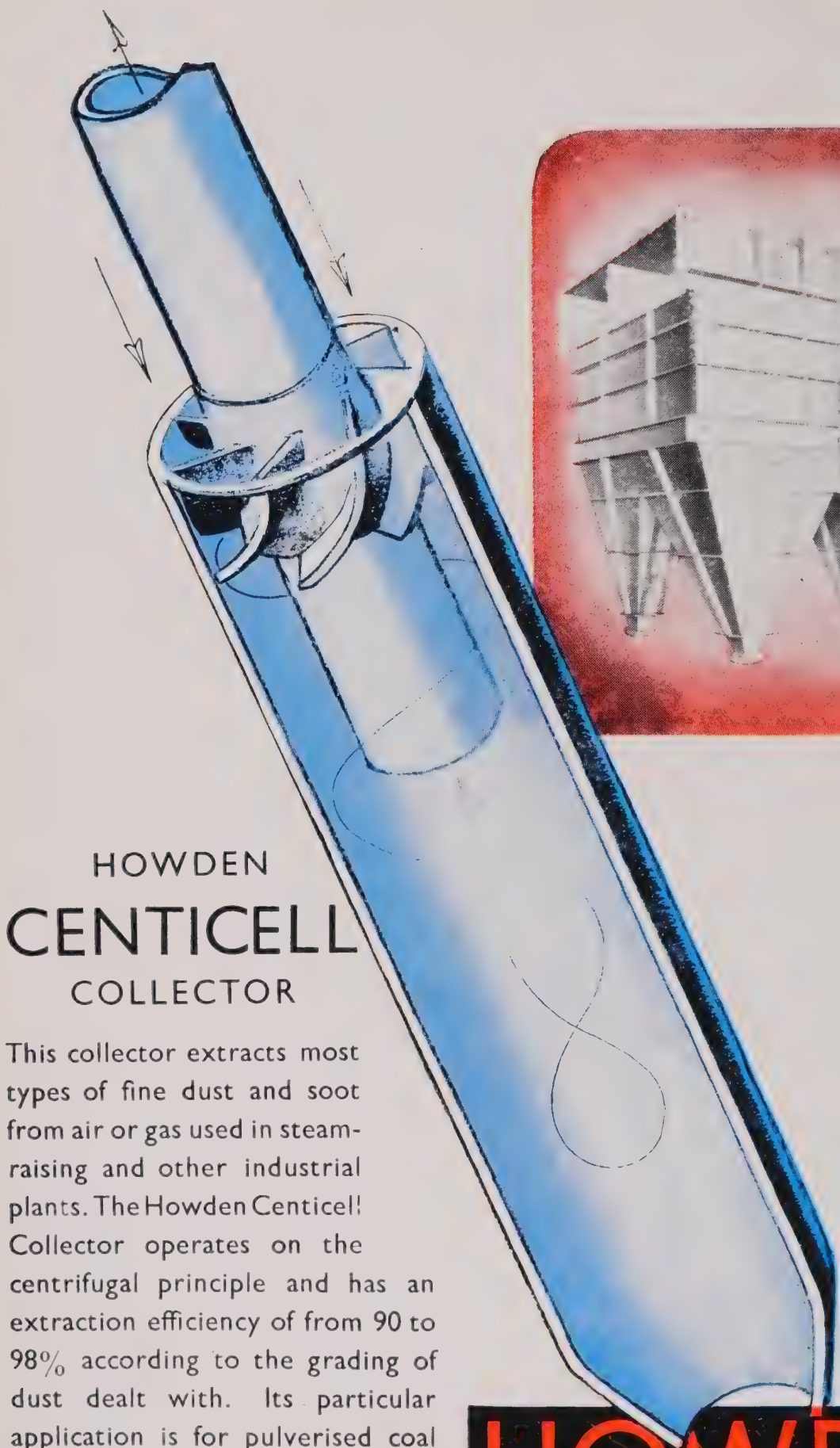


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THE SMOKE ABATEMENT JOURNAL



No. 77

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In this Issue

Local Consultative Committees

The Manchester Exhibition

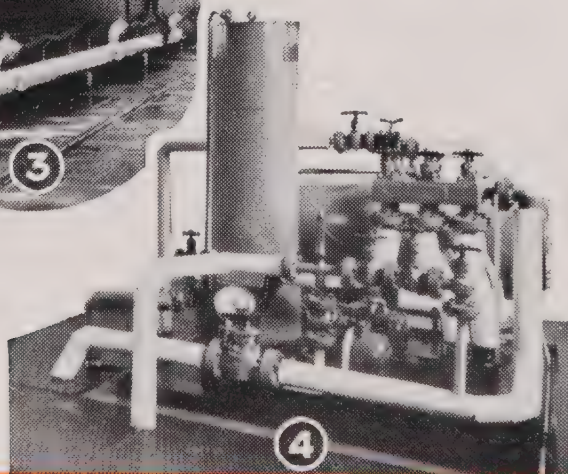
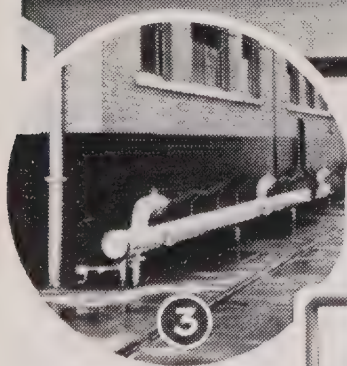
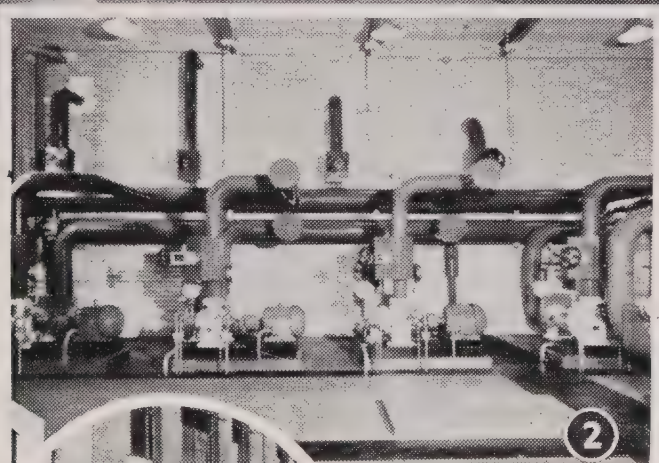
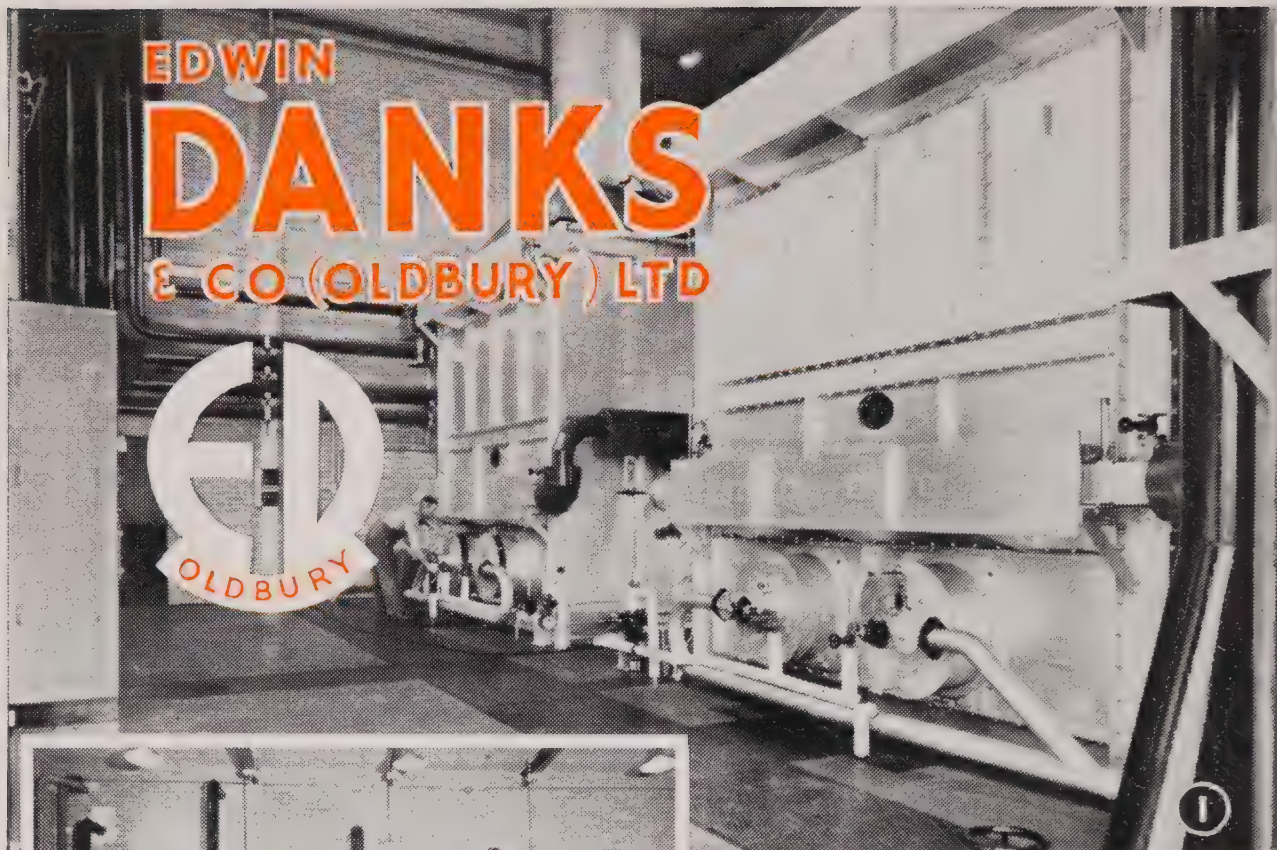
Cities Without Smoke, by Dr. A. Parker

Smokeless Fuels Review—Gas Coke

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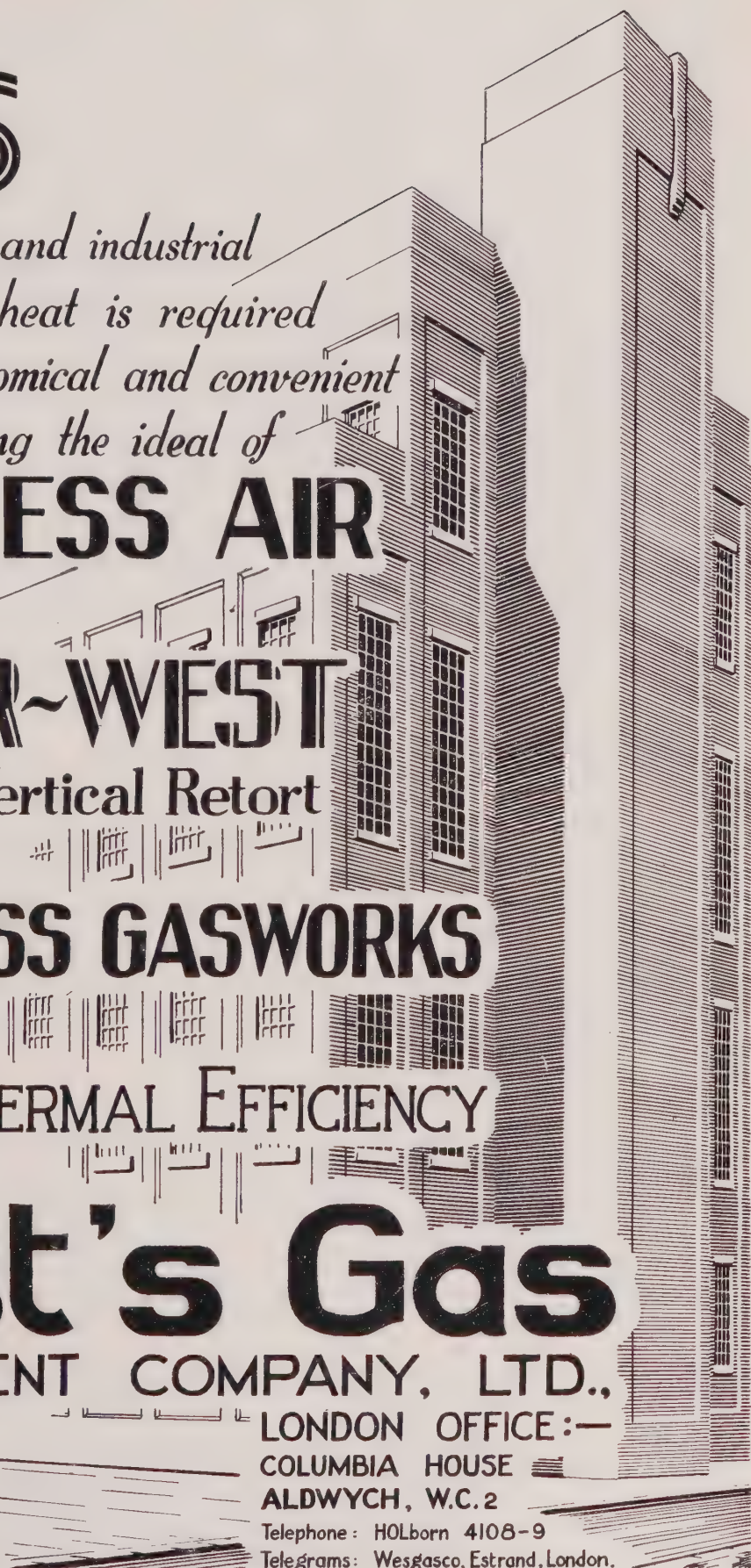
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SMOKELESS AIR

Vol. XXI. No. 77

Spring, 1951

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All bright and glittering in the smokeless air*

(See page 93)

SMOKELESS AIR

Fuel Reform by the Hard Way

READERS of that recent most entertaining book *Roads to Ruin*, which is an account of the now incredible obstacles that had to be overcome by even some of the most reasonable of reforms, will be inclined to agree that the British have a genius for making progress by whatever route seems most awkward, painful and oblique. We are now, for instance, shuffling slowly towards fuel reform by the hard road of necessity, prodded by actual shortages and danger of a major crisis.

The paradox that is beginning to be

seen is that if we are fortunate fuel supplies will be difficult for many years to come, with relative abundance likely only if there is a sharp fall in industrial production and employment. From this it follows that if we are to avoid recurring crises and discomforts we must at last go in for fuel reform in a really big way, instead of just nibbling round the edges.

The reforms needed involve both practice and principle. Practice covers what is understood by fuel efficiency, while principle brings in the more

abstruse and controversial questions of how to ensure that for each job the fuel used is the one that is most advantageous to both the user and the nation, after weighing and balancing all the factors. (Incidentally, one of the factors that must not be overlooked is the *social consequences* of any particular use of fuel).

Among much recent discussion particular interest has been aroused by an article on the urgent need for a national fuel policy by Dr. F. E. Simon, Professor of Thermodynamics, University of Oxford*, which appeared in the *Financial Times* on January 5th, 1951. Dr. Simon has some forthright things to say about the use of electricity and the open coal fire for domestic heating. He concludes that the use of electricity for heating and cooking is at present an "unjustifiable luxury," and since, to implement the fuel policy we need, one cannot destroy existing appliances, there should be penalizing tariffs for electricity above a certain number of units of "legitimate use."

Dr. Simon urges the immediate abolition of open fires and their replacement by simple stoves designed to fit into any existing fireplace. He believes "that the Government could not spend any money more profitably than by offering to provide and install such stoves free of charge." If the response were not good enough, then he would allocate only so much coal to every household "as is sufficient when proper heating methods are employed."

Since all these, and other points made by Dr. Simon have a direct bearing on the problem of smoke abolition, it would not be out of place to discuss them at length. But at the moment we will enlarge only on the proposal—which echoes recommendations of the Domestic Fuel Policy Report of 1946—for subsidizing a "new grates for old" operation. Powers to do this already exist in the new local Acts that provide for smokeless zones, and in Salford, where the first mainly residential

smokeless zones are planned, municipal assistance for the changes has been approved to a total of some £16,000. The practical advantages of smokeless zones as defined, workable areas for such fuel reform operations, apart from their original purpose, will be obvious.

Priority for Fuel Savers?

On the question of fuel, Dr. Simon's suggestion that each household should be allotted the amount it needs, as measured by standards of reasonable efficiency, is of considerable interest. In theory it seems to be correct, and although its practical administration might present difficulties, the mere consideration of such a scheme in public would be a most effective spur to progress.

An immediate point of some importance, which many of our members have experienced of late, is that during periods of fuel shortage people who normally are quite happy wasting bituminous coal in stool-bottom grates, grab out for the smokeless fuels (about which at other times they are quite indifferent) and so deprive the more enlightened consumer of the fuel he would be using with efficiency in his stove or improved fire. This was touched on in a thoughtful leader in the *Manchester Guardian* (February 3rd, 1951), which said: "It would be nice to think that the more positive smoke abaters are now getting their reward. But when coal is short so are the smokeless fuels, and the rush for coke, even by the old-fashioned open-fire addicts, is only checked when there is no more coke to be had."*

This amounts to a plain discouragement to those who would save fuel, and it seems that it would not only be just to the individual, but to the general advantage, if not to be as severe as Dr. Simon proposes, then at least to give

* The article continues by discussing views expressed at the N.S.A.S. Margate conference, and the "cleaner air" zones suggested by the C.U.J.C., which the *Guardian* says "does not sound the sort of appeasement the National Smoke Abatement Society would tolerate."

*See this Journal, Autumn, 1949, for report of a paper by Dr. Simon on "Power Sources and Power Utilization."

priority in times of shortage to those who will use their fuel to the best advantage. People who are going to waste most of their fuel surely deserve to come last. Why not, then, divide domestic consumers into grades, with closable stove users (60 per cent. efficiency) in the top grade, and the stool-bottom, etc., people (20 per cent. or less efficiency) down at the bottom? Then, particularly for the smokeless fuels, priority in supply can be given to Grade I consumers, and so on. The germ of this idea already exists in the "small anthracite" scheme about which Lord Hyndley spoke at the opening of the Manchester Fuel Efficiency Exhibition, under which the small supplies of this specially prized grade of fuel are reserved for consumers with certain appliances that require it.

The New Chairman

Mr. Sydney N. Duguid, a member of the Society since its formation, has been elected Chairman of the Executive Council in succession to the late Mr. Charles Gandy. Mr. Duguid is a fuel technologist and one of the most popular and effective of lecturers on fuel efficiency, boiler-house practice and smoke abatement. For many years he has conducted classes for stokers in Manchester and has had much to do with the films and publications of the Ministry of Fuel and Power. He is Chairman of the North West Section of the Institute of Fuel and played a great part in the organization of the recent Fuel Efficiency Exhibition. Mr. Duguid has the rare gift of being able to brighten even the most serious of discourses with a happy and contagious humour. We wanted a photograph of him to illustrate this note, and by chance discovered the excellent "candid camera" picture that appears on page 95, taken with Lord Hyndley during a tour of the Exhibition.

New Members

During the past year we have been pleased to include among new members of the Society the following important

bodies: the British Electricity Authority and its Divisions and Area Boards, the National Coal Board, the Railway Executive (British Railways), and the British Iron and Steel Federation. The Gas Council and the Area Gas Boards were already members. Not only are the subscriptions of these members helping the Society to make ends meet, but as "national institutions" they are directly represented on the Executive Council and its Committees—especially the Technical Committee. With the local authority members and officers elected by the Divisions and individual members, the Executive Council is now stronger and more representative than ever before, and is certainly the best permanent body for smoke abatement ever built up.

Development in the U.S.A.

The 44 year old Smoke Prevention Association of America has recently been reorganized and is now known as the Air Pollution and Smoke Prevention Association of America. Its national headquarters are to be at the Mellon Institute, Pittsburgh, and for the first time a full-time Executive Secretary has been appointed. This is Mr. Robert T. Griebing, a graduate of Wisconsin University, who has been previously engaged in public relations and public health work. We are very pleased to hear of this development and offer our very good wishes for future success to both the Association and Mr. Griebing personally. In our next issue we hope to give more information about the Association, its plans, objectives and membership.

Frontispiece Picture

Our frontispiece "smokeless air" picture is from "Castle on a River in Holland," by J. Storck, and is reproduced by kind permission of the Trustees of the Wallace Collection. More nearly than any other illustration we have used it depicts the "ships, towers, domes, theatres and temples" of our familiar quotation, and is a change that we hope readers will like.

THE MANCHESTER EXHIBITION

A Successful Enterprise

BECAUSE our last number had to be well under way before the opening of the Fuel Efficiency Exhibition in Manchester it was possible to include in it only a brief note of this notable event. But it is not too late to give a fuller record of what proved to be the best and most successful exhibition of its kind ever held in this country. It was ably organized by Provincial Exhibitions, Ltd., under the auspices of the Society. A national Advisory Committee was convened by the Society, on which were represented all the principal interests concerned with fuel and power, including the Ministry, the national Boards, and the technical institutions. Locally, a similar committee (which incidentally had much more to do) was set up by the Society's North West Division.

The Opening

The Exhibition was opened on November 22nd by the Chairman of the National Coal Board, the Rt. Hon. Viscount Hyndley, with the Lord Mayor of Manchester, Alderman Col. S. P. Dawson, in the Chair. The large lecture hall off the exhibition halls was well filled and Lord Hyndley's speech was listened to with appreciation. After referring to the Society and the wide support the Exhibition had received, Lord Hyndley continued:

"The National Coal Board, who are the producers of the 'offending object' (namely, the raw coal which is the principal cause of the smoke nuisance), are in full agreement with the aims and objects of the Society. That may sound a bit Irish; so let me explain.



The Society's Stand



At the Opening—(left to right) S. N. Duguid, the Society's new Chairman, Lord Hyndley, and T. J. Sales, Marketing Director, N.W. Division, N.C.B.

As well as producing raw coal the Board also produce a large amount of smokeless fuels. For instance, we have coke ovens in most of our Divisions; last year they produced $6\frac{1}{2}$ million tons of coke. Most of it was used in the production of iron and steel, but nearly two million tons went to other industry and into domestic fires and boilers. We also make Phurnacite. This is a specially carbonized briquette that can be used instead of anthracite. It is made in South Wales, and we are extending the plant so as to produce double the present quantity."

Speaking of the drive to equip homes with more efficient appliances, Lord Hyndley said: "There is immense scope for improvement. I am sure I am not far wrong when I say that every single home in the country can do with at least one new and more efficient appliance—a fireplace, a stove, a boiler or the like. By making them really efficient, the householder will not only be doing a great service to the nation but also—and this should be most welcome to everyone these days—

he will cut down his household expenditure surprisingly."

Lord Hyndley concluded by saying: "It may be true to say that 'where there's smoke there's fire'; but we must see to it that it need not be true that where there's fire there's smoke."

"In all this I can assure you of the complete goodwill and wholehearted support of the National Coal Board. The problems are complicated and difficult. But exhibitions of this kind enable the public to see the great strides which have been made since the war in the design of appliances, and this can do nothing but good. I wish your Society every success in their great work and I have pleasure in declaring this splendid Exhibition open."

Lord Hyndley was thanked by the Society's President, Dame Vera Laughton Mathews, and by Mr. S. N. Duguid, who had been Chairman of the North West Division sub-committee concerned with the Exhibition.

A Message from the Minister of Fuel and Power

The Organizers and the Society were very pleased to receive a message from the Minister, the Rt. Hon. Philip J. Noel-Baker, M.P., in which he said:

"Fuel Efficiency and Smoke Abatement go hand in hand. The National Smoke Abatement Society have this year come of age; it is fitting that it should celebrate this happy event by sponsoring the Exhibition in Manchester on 'Fuel Efficiency in Industry and the Home.'

"Much thought and effort have gone into its preparation and presentation; the lessons it embodies are the results of proved experience in many fields. I have been keenly interested to learn of the many organizations, both national and local, which have contributed to this work.

"The Exhibitors, by giving their co-operation, have made possible the display of a wide variety of materials and equipment of interest to everyone who used fuel. That means to all of us. Fuel efficiency is a many-sided subject. Big advances have been made in fuel technology in recent years and research



The North West Gas Board Stand

work is steadily advancing the efficient use of fuel both in industry and the home.

"The results of this work will be increasingly apparent as time goes on; but there are already substantial and immediate benefits to be secured by the fullest application of existing knowledge.

"I have great hopes of the Exhibition. I believe it will stimulate thought, stir the social conscience, perhaps help to launch some new inventor who will make an important contribution to the future progress of the cause. I am sure it will be seen by many visitors; and it will send them home resolved to play their individual part, in their factories, in their workshops and their homes, in ensuring that the nation's fuel is better used than it has been in the past. That in itself will be a great result, and a great service to the nation in these crucial post-war years."

The Stands

There were nearly 80 exhibitors, and in addition the gallery above the main

hall was filled with a most interesting display of models of fuel-burning and engineering plant, loaned by upwards of thirty firms and associations. Thanks are due to Mr. G. F. Ward, of Manchester, for his considerable help in bringing together this material.

One of the most frequent comments of visitors was about the outstanding quality of the design of the stands. The skilful and attractive presentation of the individual exhibits gave the show as a whole an air of colourful distinction. There was not a dull corner to be found.

It would be impossible to survey the stands individually, but it can be said that no important aspect of fuel in all its forms, or of its use by the most modern and efficient appliances, was missing. While there were more stands concerned with the industrial uses of fuel than with the domestic, there was in fact sufficient of the latter to demonstrate fully to the householder what he or she could do to raise their fuel-burning standards. All the national fuel and power authorities were present,

as was British Railways and the Fuel Research Station (D.S.I.R.).

The Society itself had one stand, necessarily modest in comparison with many others, which created considerable attention and led to numerous inquiries and discussions with visitors. Greatly appreciated were the turns of help given by members of the North West Division, and volunteers from the staffs of member local authorities. A number of new members have been enrolled as a result of the exhibition, and among them we were particularly pleased with a subscription from a Manchester-born man, who living now in the United States, did not see the Exhibition but happened to read a newspaper report of it.

Attendances were very good, especially as most of the visitors—who came from all parts of the country—were genuinely interested. The exhibitors were pleased with the inquiries they received, and as one said “We met many old friends there, and made a lot of new ones.”

The Lectures and Films

Through the Manchester sub-committee, with Mr. Harold Moore as its Hon. Secretary, arrangements were made with other organizations for lectures to be held every afternoon during the course of the exhibition. Thus, for example, there was a joint meeting of the Institutes of Fuel and of Heating and Ventilating Engineers, and another for members of the Institutes of Iron and Steel and of Plant Engineers. One Saturday afternoon was given over to a meeting of boiler house firemen and engineers, arranged through the Unions concerned. The N.C.B., Gas and Electricity Boards, and Low Temperature Coal Distillers' Association also had afternoons. Each evening there was a film show in the lecture hall, with a variety of fuel, heating, and similar films in the programme.

The first of the meetings was a joint one of the Society of Medical Officers of Health and the Sanitary Inspectors' Association, at which papers were read by Dr. J. T. C. Keddie, of Oldham, and Mr. J. Gaskell, of Crewe. The Society's General Secretary, Mr. Arnold Marsh, presided in place of the late Chairman, Mr. Charles Gandy.

Dr. Keddie's Paper

This was a valuable and up-to-date review of the effects of smoke on health. The following excerpt may be quoted in full :

“The continuous inhalation of the pollutants in the atmosphere is bound to produce harmful changes in the sensitive lining membranes of the nose, throat and lungs. The main effect is to produce chronic or sub-acute inflammation. As regards the upper respiratory tract, strict scientific evidence is lacking, though the ‘Ear, Nose and Throat Club’ of St. Louis, Missouri, claimed that smoke is an irritant to the membranes of the respiratory passages,



The Radiation, Ltd. Stand



The James Hodgkinson (Salford) Ltd. Stand

creating a fertile field for secondary infections. Following the smoke abatement drive in that city, various physicians testified to the decreased incidence of mucous membrane irritation, colds, sinusitis and infections of the trachea-bronchial tree. In this country I do not think any physician would deny that there exists a higher incidence of naso-pharynx infection among dwellers in our smoke-laden cities, than in the rural communities, especially in this case among children.

“Upon the lungs we depend for a constant supply of fresh oxygen and the removal of a large proportion of the waste materials of the body. Interference with this action must have harmful results on the general well-being of the individual and the depositing of particulate matter will result in lung changes. Not only does particulate matter cause damage to the sensitive lung tissue but it enhances by absorption, the effect of irritant gases. A gas such as sulphur dioxide which would

normally exert its primary action in the upper part of the respiratory tract would, if carried to the deeper parts of the lung by particulate matter, produce more serious effects.

“As regards lung disease and atmospheric pollution, few morbidity statistics are available but there is ample evidence when mortality from respiratory diseases is considered. Osborne (1928) records that the year 1926 saw the lowest death rate recorded for Salford, and the biggest reduction was in deaths due to respiratory diseases. He correlates this with the prolonged coal strike and the consequent relatively pure atmosphere for that year.

“Leonard *et al* (1943) working in Dublin observed the amount of pollution over the period 1938 to 1942 and found that periods of minimum temperature were also periods of maximal pollution and that such periods were followed by the maximal rise in deaths. From 1940 onwards there was a coal shortage and a progressive decline in

pollution due to suspended impurity and sulphur dioxide was recorded, with a similar decline in deaths. I regard this as particularly valuable evidence against the smoke menace."

Mr. Gaskell's Paper

Mr. Gaskell surveyed the problem over a much wider field, and from his paper—which lead to some lively discussion—the following interesting paragraphs are extracted :

"The attack on smoke appears to me to have been fundamentally wrong. Attention has been directed primarily to control of emissions rather than by controlling the conditions giving rise to the emissions. I believe that had local authorities' activities been mainly focussed on remedying the conditions rather than investigating conditions after offences had taken place, we should have made very much more progress in the last fifty years than has been the case.

"If this conception of smoke abolition was acceptable, would local

authorities be capable of carrying out their responsibilities fully ?

"If the answer to the last question is in the negative let us ask ourselves another question. Would local authorities have made greater progress had they combined to form joint statutory committees and had had at their disposal specialist smoke inspectors and other technical officers or would they have been better forming more regional joint consultative committees ? It should be mentioned that a number of authorities in different parts of the country have in the past, and do at present, form regional smoke abatement committees, but only one group of authorities—Sheffield, Rotherham and District—have thought fit to avail themselves of the power to form a joint statutory body.

"To take the argument a step further, has the time arrived when a centralized inspectorate should be set up under the Ministry of Fuel and Power, complete with expert fuel technologists, techni-



The Coalite and Chemical Products, Ltd. Stand



The North Western Electricity Board Stand

cians and smoke inspectors?

"The prior approval clauses for commercial and industrial plant, which a number of local authorities have obtained in local Acts are of course operated by the authority. If this principle of prior approval was adopted by the Ministry of Fuel and Power from the point of view of fuel efficiency and economy in the use of fuel, the Ministry would in all probability set up an inspectorate for this purpose and local authorities' powers in that regard would lapse. If the Ministry's inspectors undertook those duties would there

then be the same case to argue for the statutory joint boards?

"I leave these matters to your observations. I would only say this, that it seems to me after some twenty-one years in the local government service that there is within the framework of the service sufficient scope and flexibility for the whole field of smoke abatement to be carried out by the authorities, provided there is access to consultant expert fuel technologists. Perhaps the Ministry of Fuel and Power could fill this gap in the local authorities' system of control."

SMOKE ON THE AIR

The case for smoke abatement has had a good show by the B.B.C. during the past few months. In November there were two talks, one on the North of England Home Service by Dr. J. S. G. Burnett, Medical Officer of Health for Preston, and one in "Science Survey" on the Home Service by Dr.

A. C. Monkhouse, Assistant Director, Fuel Research Station. In January, Arnold Marsh, the Society's Secretary, took part in a "Fog" feature in the television programme—in which he discussed the problem with Richard Dimbleby. Dr. Burnett is a member of the Society's Executive Council and the new Chairman of the North West Divisional Council.

Local Consultative Committees

A New Form of Organization

SMOKE prevention work today is becoming less a matter of punitive action against arbitrarily defined offenders, and more a matter of co-operation between all interests for the purpose of solving existing problems by constructive action, and of planning to avoid new problems by one form or another of "prior approval"—a term which should always be understood to include "prior consultation." Apart from all legal requirements much is being done, and a great deal more can be done, by means of joint discussion between all parties concerned.

This is needed at different levels, from the most general, or national, to the particular, or local. Hitherto there has been national and regional organization, but very little able to deal with the concrete problems that concern a community. Regionally there are several advisory committees of local authorities, which are active in varying degrees, and more recently the Divisional Councils of the N.S.A.S., which are "joint" in the sense that they bring together many different interests and points of view. A regional body (except a statutory one with ample full-time staff) obviously cannot give detailed attention to individual problems, especially when a knowledge of local conditions is needed, no matter how effective its work at its own level may be.

Although the Society is now strong enough to have set up Divisional organizations it has not the requisite mass membership to form purely local representative groups. We welcome therefore the formation, within the last four years, of three local joint committees of a new type. In each case the initiative has come from the local authority. The three towns, all in Lancashire, are Widnes, St. Helens, and Burnley. The nature and scope of the committees can best be explained by considering each one in turn.

Widnes

This was the first of the committees, and was set up in January, 1947. Its interests can be illustrated by reference to its membership, as follows:

The local authority	...	4
Factory owners	...	7
Gas and Electricity Boards		2
Builders		1
Women's organizations...		1

In addition, the Alkali, etc., Inspector for the district, and the Fuel Engineer, North West Region, Ministry of Fuel and Power, are advisory members.

Meetings are held quarterly, when the Senior Sanitary Inspector, who is in charge of smoke prevention measures in Widnes, submits a report and records of smoke observations, measurements of pollution, weather, etc. Problems and difficulties being experienced by industrial members are also discussed and valuable information is exchanged.

The Committee have with considerable success supported factory owners in applying for licences for steel, the purchase of fans, etc., in their endeavour to improve furnace plant and consequent smoke emission, and also in regard to changes of fuel. The Committee have visited one or two of the local works (by invitation of the management) where conditions may be regarded as difficult, and in contrast a forthcoming visit will be to a modern colliery equipped with the most up-to-date automatic firing appliances.

The Town Clerk acts as Clerk to the Committee and reports the proceedings to the Health Committee of the Council, who bear the cost of any recommendations involving expenditure. The amount provided in the estimates of the Council for atmospheric pollution for 1950-51 is £400.

It is pointed out that it was realized at the outset that the policy then determined was a long-term one and immediate results were not expected,

but it is interesting to note that prior to the formation of the Committee in 1947, the average monthly deposit in tons per square mile was in excess of 35. Since then, on one occasion only (early 1947) has that figure been reached, and the average during 1950 was 25 tons. Recorded observations of factory smoke also show a fall in the numbers exceeding the permitted standard.

Among other activities may be mentioned the showing of films on boiler house practice, the setting up of classes for stokers, participation in exhibitions, and the publication of leaflets. An excellent new one, in colour and with photographs, is being distributed to every household in the borough. On the domestic side—which, as the representation of women's organizations on the Committee shows, is not being neglected—steps are taken to encourage builders and householders to install fireplaces for the burning of smokeless fuels, and evidence is not lacking to show progress in the process of conversion. The local authority in their new houses and in the replacement of fireplaces use only appliances which are capable of burning smokeless fuel.

St. Helens

The St. Helens and District (Atmospheric Pollution) Joint Consultative Committee was formed in June, 1949, as a result of recommendations made in a comprehensive report on atmospheric pollution in St. Helens made by Mr. E. Sefton, Chief Sanitary Inspector. A first difference from the Widnes Committee to be noted is that it is not confined to the borough but includes representatives of adjoining authorities—Whiston R.D.C. and Prescot U.D.C. Both the St. Helens Public Health and Housing Committees are represented, and there are also representatives from industries in the area, the National Coal Board, the Gas and Electricity Boards, and, as Advisory members, the Alkali, etc., Works Inspector and the Fuel Engineer, North West Region, of the Ministry of Fuel and Power.

The stated objects of the Committee include consideration of reports of progress and of preventable emissions

submitted by the Health Department; special difficulties and fuel problems experienced by manufacturers; general problems of fuel economy and new developments in technique; the education of boiler house firemen; and action “as a liaison between the Sanitary Authorities concerned and manufacturers.”

The Committee has already dealt with problems particularly affecting the area, such as the burning-out of producer gas flues, colliery chimneys and burning spoilbanks. Efforts to start classes for boilerhouse men have not so far been successful.

The problems to be faced by the Committee are outlined in the report of the Chief Sanitary Inspector, mentioned above. One of his conclusions was that much of the smoke emitted in the area could be prevented, and another was that “in the anxiety of manufacturers to keep pace with postwar industrial conditions considerations of public health and of the other adverse effects of atmospheric pollution would appear to have been overlooked.” There was a lack of proper training of staff in stoking and boiler house management, and many faults were so inexcusable that legal proceedings would have been justifiable.”

A further conclusion is of particular interest for the support it gives to a generally expressed conclusion: “The general excuse that inferior fuel is the cause of excessive emissions of smoke cannot be accepted in view of the fact that the recent survey has revealed so many faults both in regard to inefficient stoking and boiler plants.”

Since the retirement of the former Medical Officer of Health, Dr. F. Hauxwell, the Hon. Secretary to the Committee has been his successor, Dr. G. O'Brien.

Burnley

The Burnley Smoke Abatement Advisory Committee was set up in November, 1949. It is constituted similarly to the Committees already described, but it is of interest to note that its membership covers a wider field than the others.

There are representatives from the Burnley County Borough and Rural District Councils, the Gas, Electricity and Coal Boards, the Chambers of Trade and of Commerce, the Trades and Labour Council, individual Trade Unions with special interest in the problem, the Railway Executive and the Road Haulage Executive, the Municipal College and its Engineering and Mining Departments, and—apparently the only women's interest—the Women's Gas Council.

The functions of the Committee are similar to those of the St. Helens Committee, but stress is also laid on the fostering of interest in smoke abatement and the carrying out of propaganda.

The Committee meets once every three months, and discussion is centred mainly on ways and means of smoke abatement in the concentrated industrial area, and the arrangement and development of film shows and lectures to suit all types of people interested in the subject. So far, two series of special short course lectures, especially for boiler attendants, have been run, with one film show and lecture open to the general public. Both of these were well attended and their success has encouraged the Committee to run a course of six lectures, now in progress, with Mr. S. N. Duguid (the new Chairman of the N.S.A.S. Executive Council) as lecturer. There are also more technical courses in the Technical College on boiler house practice.

Expenses have been so far quite light, and have been met by the Health Department and the Education Authority jointly. It appears that in Burnley the Technical College acts as a centre for all activities, and that its contacts with other bodies of all kinds is a factor of importance in the successful growth of the Committee's influence.

The Chairman is Councillor W. Heap, and the Hon. Secretary, Mr. F. Shuttleworth, Chief Sanitary Inspector.

* * *

It will be seen that the three Committees, though closely akin in character and purpose, show variations in emphasis and direction. These

differences are in themselves indications of how such bodies can shape themselves to the precise needs and interests of their areas. They are essentially local, and it is in this that their special value lies.

This article—which it should be admitted is overdue—has been written not just as a matter of topical interest, nor only to congratulate and wish further success to all those concerned in the running of the committees, but also in the hope that many other local authorities will consider whether their conditions are such that they can take similar action. The experience of Widnes, St. Helens and Burnley may make it all seem easier than it is—not just to start such a committee, but to keep it in being, pegging steadily at a long-term policy. Possibly a certain intensity of pollution is needed to give and keep the necessary impetus. If so, there are plenty of other towns that could follow with assurance the example of these three pioneer Lancashire boroughs.

A.M.

Salford's Smokeless Zones

Salford City Council has approved the terms of the Order creating smokeless zones in the Lower Kersal, Weaste, and Duchy Road areas, and Ministerial confirmation is now being sought. The Order excludes from the first of the three zones the boiler house of a Prestwich works of the Bradford Dyers' Association. With the Order is a Schedule defining the three areas.

The installation of appliances suitable for smokeless fuels in the Corporation's prewar houses and flats in the smokeless zones is being financed by the Corporation. The total of £16,000 includes the conversion of 1,497 coal-burning grates, the provision and installation of 45 gas cookers, and provision of gas ignition for them all. Assistance of up to £2 per house is also proposed for private householders requiring to make alterations.

SMOKELESS HOMES



Towards Perfection

THE Electrical Association for Women are carrying out an elaborate inquiry on the design and performance of domestic electric apparatus, in which they are asking for the co-operation of their ten thousand members—and anyone else who may be interested. A complete series of question papers, each dealing with a specific electrical appliance, has been prepared within the covers of a booklet entitled *Towards Perfection*. On electric irons alone, for example, there are forty main and subsidiary questions. Cookers, space heaters, kettles, refrigerators, vacuum cleaners, water heaters, washing machines and washboilers all come under scrutiny, with such questions as: “In what position on the hob do you prefer to have (a) the griller boiler and (b) the quick-boiling plate?” “What is your opinion of the fire guards now available for electric fires?” “How long do you estimate is spent in cleaning your refrigerator?”

Laughing Water

Apropos of washboilers, the Gas Council recently gave a preview of a new film in which laughter and water were well mixed. This half-hour film, “Method and Madness,” is about home laundry with gas appliances. The risky, but in this case completely successful, treatment used for what could have been a rather dull subject is simply that of hilarious, knockabout comedy. Richard Hearne plays the part of a Mr. Pastry, a mildly foolish and well-meaning husband, who tries to show his wife that old-fashioned

methods of clothes washing are quite good enough. The ghastly mess he makes of his demonstration leads finally to his conversion to the modern methods his wife has seen at a very different kind of demonstration at the local gas showrooms. It is much funnier than many a film that has no other purpose than to be funny. Also in the programme were two excellent new films for children telling the story of coal from primeval days to its transformation into gas and coke.

Calls for Co-operation

The fact that gas and electricity are now both under the same public ownership suggests to many people new possibilities of co-operation between the two industries. One housewife has recently asked us, for instance, whether there is now any chance of her seeing what she has always wanted—a cooker with electric oven and gas boiling rings. Another query put to us is whether economy and convenience could not be achieved by having gas and electricity meter-reading done at the one time by one official. Not feeling competent to comment on either of these ideas we present them to our electricity and gas friends for their consideration.

Fifty Years On

An informative and well-illustrated review of “Domestic Solid Fuel Appliances, 1900-1950.” by John Pinckheard, A.R.I.B.A., appeared in *The Architect and Building News* for January 19th, 1951. The author covers in interesting detail, the story of the

development of cookers, open fires, and stoves during the half century. He refers to the tests organized between 1901 and 1905 by the Coal Smoke Abatement Society, one of our own parents, on "smoke consuming" grates. The slow combustion stove, embodying most of the features found in the highly efficient modern stoves, was introduced into this country from France in 1903, while in 1924 the openable stove came from Denmark.

Appreciation

We cannot refrain from mentioning

with thanks the action of the woman member of the Society who has very kindly doubled her subscription because of the saving she has made in her smokeless home by not having to have her chimney swept!

Change of Name

To avoid confusion between the Gas Council, which is an official body established by Act of Parliament, and the Women's Gas Council, which is a voluntary organization, the latter has changed its name to the Women's Gas Federation.

News from the Divisions

The first meeting of the new **West Midlands** Division, held in Birmingham on November 1st, 1950, took the form of a joint "Brains Trust" on smoke abatement with the Midland Section of the Institute of Fuel. Mr. Edgar Evans took the Chair and the members of the Trust were Mrs. A. L. Hayes, Dr. W. R. Martine, Mr. G. W. Farquharson, Professor Stacey G. Ward, Mr. L. F. Jeffrey, and Mr. C. Machen.

A well-assorted series of questions were answered very effectively. They dealt with open coal fires, fuel efficiency in industry, the possibility of a smokeless zone in Birmingham, whether domestic smoke was more injurious than industrial, smoke from the use of creosote pitch and oil, the quality of coke, and the use of instruments and automatic control with industrial furnaces. There was also one which read as follows: "It is generally agreed that the most efficient form of industrial fuel utilization is represented by a balanced combined steam for power and process cycle. What are the views of the Brains Trust on the practicability of linking the final exhaust from gas turbines to steam generators for industrial process and heating work?" A more unusual one, which had only one brief comment made upon it in

answer, was "In view of the fact that the expectation of life in Great Britain has been rising steadily and continuously over the last half century, is it not possible that the human body is building up its own resistance to industrial smoke and fumes, and that if we are sufficiently patient the smoke hazard will largely disappear from the public health aspect?" The comment was Dr. Martine's, who said: "I would give an unqualified 'No'."

The Annual General Meeting of the West Midlands Divisional Council will be held on April 12th.



The Annual General Meeting of the **Yorkshire** Division was held in Leeds on November 20th, 1950. In addition to business which included consideration of the annual report and announcements of election results for officers and Council, an address was given by the Chairman, Mr. T. Henry Turner, on "Progress of Smoke Abatement in Yorkshire." Mr. Turner dealt factually with some of the more important aspects of the problem in the county, including the growth of measurements of pollution, railway smoke, gas and electricity utilization, grit prevention from power stations, and the question of the collieries.

On the last Mr. Turner may be quoted at length :

"From the point of view of our Society and the smoke-shrouded taxpayers, the long plumes of black smoke to be seen from colliery chimneys throughout the County will be regarded as a challenge to the N.C.B. Black smoke from colliery chimneys tends to make slums of what could be model villages. Mine Welfare authorities should join forces with us enthusiastically in combating the smoke from these 140 chimneys for the dirt from them must be even more objectionable to the miners' wives and children than to those who live further from them. Mining villages are also made filthy by the relatively poor quality engine coal which miners receive by custom as part of their remuneration and burn in open grates of perhaps 15 per cent. efficiency. Wherever the N.C.B. is the new owner of property in which miners live, we would implore them to bear in mind that it is our Government's policy to replace old-fashioned raw coal burning fireplaces with their mere 20 per cent. of less efficiency, by convector fires, openable stoves or other modern fireplaces which in some cases have efficiencies as high as 60 per cent. If all miners' cottages were so fitted, they would halve the smoke in the village and probably provide twice the useful heat in the cottages. This is a problem which must be tackled by the N.C.B. and Mine Welfare authorities, for electrification of pits will not remove the old-fashioned cottage grates."



The **North East Division** held a meeting in Newcastle-upon-Tyne on March 1st, at which an address was given by Dr. D. T. A. Townend, Director General of the British Coal Utilization Research Association, and the author of the first Des Vocux Lecture, read at the Society's Margate conference last year. The **Tees-side Committee** has continued to be most active in investigating the problems with which the area is mainly con-

cerned. Discussions have been held with the representatives of industries, including the railways, the docks and inland waterways, and the iron and steel concerns.



The **Scottish Division** is to hold its two-day Annual Conference in Inverness on May 24th and 25th. Railway smoke and the effects of smoke on agriculture in Scotland will be among the subjects to be discussed. Inverness is the most northerly of all the Society's local authority members.



In the **North West Division** Dr. J. S. G. Burnett, of Preston, has been elected Chairman in place of Alderman Professor F. E. Tylecote, and Councillor J. Longton, of Widnes, Deputy Chairman.

Industrial Thames-side

Here all is dull and lifeless, flat and grey,
Grey sky, grey roofs and straight, grey-
metalled road.

Here willow-slender chimneys belch their
load

Of grey smoke upward, ceaseless, night and
day.

Even when the warm spring sun brings out
in May

Her tender blossoms, and the trees have
showed,

Green, dancing buds, or, where the wheat
was sowed.

Green lanes quiver ; on them all they lay
The grey cement dust. Yet, when night is
here,

And all the ships along the river glow
With emerald, red and white, and, over all,
The clear, cold skies like diamonds bright
appear,

The grimy slattern that by day we know
Glitters like Cinderella at the ball.

—Rose Pugh.
Stanford-le-Hope, Essex.

Commended—The following resolution was recently passed by the Brighouse (W.R. Yorks) Health and Cleansing Committee: "That the industrial firms which are taking steps to abate the smoke nuisance be informed of the success of their attempts in this connection."

Reviews

Some New Publications

Fuel Research, 1939-46. This combined report for the wartime years contains much of interest on smoke abatement, both directly and indirectly. It describes the development of the smoke eliminator, first for use in merchant ships, and epitomizes the work done on domestic heating and the research and investigations on atmospheric pollution. A section on special wartime projects will be of special interest to many readers. (Department of Scientific and Industrial Research; H.M. Stationery Office, London, 1950. pp. 69, 3s.).

Progress in Coal Science is the title of an important record of research into some of the fundamental problems of use and understanding of the nature of coal. It was edited by the late Dr. D. H. Bangham, Director of Research, British Coal Utilization Research Association, and most of the material has been selected from a series of articles previously privately circulated in the monthly bulletin of the Association. The principal sections of the book relate to modern experimental technique, fine particles, the constituents of coal, the organic chemistry of coal products, and chemical aspects of combustion and gasification. In all there are 26 papers or reviews by different authors. (Butterworth's Scientific Publications, London, 1950. pp. xi + 447; 40s.).

At the other end of the ladder of scientific learning is a new text-book, **A School Chemistry for Today**, by F. W. Goddard and Kenneth Hutton. We do not review this because Mr. Hutton is a member of the Society, but because the book is a first-class work that very ably relates chemistry to everyday life, including, among many other things, fuels and the pollution of the atmosphere. The latter is not made the subject of isolated mention, but is referred to from time to time in various connections. There are thus nineteen

references to "smoke" in the index. The practical outlook of the book is shown by the fact that the frontispiece illustration is a view of "the largest chemical factory in the British Commonwealth"—namely, I.C.I. at Billingham. There are numerous most interesting diagrams and charts, such as one which shows the relative abundance of the elements and a drawing which indicates all the metals to be found in a kitchen—from A1 to W. Needless to say, the theoretical and experimental basis of the whole subject is well taken care of, and a clear, well-balanced book is the result. Anyone wishing to brush up his chemistry would find it admirable. (Longmans Green & Co., London, 1950. pp. 544, 8s. 6d.).

We are pleased to be able to congratulate one of the Society's corporate members on the attainment of their centenary, and to say a word of praise on the delightful book they have published to mark the occasion. The firm is W. C. Holmes & Company, Ltd., of Huddersfield, and they have aptly called the volume **One Hundred Years of Endeavour in the Service of the Gas Industry**. The growth of the firm from its earliest days is described and illustrated, and the book contains much intriguing information. Thus in an early catalogue it was announced: "Messrs. W. C. Holmes and Co. are prepared to assist in the establishment of gas works in any town or village which, after inspection, they know will return a fair dividend upon the outlay, by providing a portion of the required capital." And another early catalogue gave a price list of complete gas works, ranging in size from one retort to supply 70 lights (£100 exactly) to a 42 retort plant for 10,000 lights at £4,050.

The Federation of British Industries annual, **Fuel Economy Review, 1950** is once again a well-balanced publication that lives up to its title. There are articles on towns gas for industrial

purposes, the use of pulverized fuel for all combustion purposes, the chain grate stoker for shell boilers, the preparation of coal for the market, and others of general industrial interest. An editorial on the fifteen-year development plans of the National Coal Board points out that if consumption continues to increase at the post-war rate the existing level of production, already inadequate, will need to be considerably expanded by 1965. The article well points out that "the Board's problem, great as it is, would have been even greater today had it not been for the many millions of tons which have been saved during the past ten years by increased efficiency.

"It is the Board's responsibility to produce the nation's solid fuel requirements and they must obviously take whatever steps are necessary to safeguard the future, but in view of the probable costs every logical alternative should be explored to the full. One

obvious alternative is the attainment of a higher degree of efficiency of fuel utilization"

Periodicals Acknowledged

The Society regularly receives, as gifts or exchanges, a number of periodicals that it finds very useful, and which once in a while should be acknowledged in these columns. The list of those we would like to thank includes: *Gas Journal*, *Coke and Gas*, *Municipal Journal*, *Town and Country Planning*, *Public Health*, *Sanitarian*, *Weather*, *West's Gas*, *Far and Wide* (Guest, Keen & Nettlefold), *Howden's Quarterly*, *B.E.A.M.A. Journal*, *B.C.U.R.A. Bulletin*, *Steam Engineer*, *Industrial Heating Engineer*, *Combustion Engineering*, *Municipal Review* (Assoc. Municipal Corporations), *Industrial Hygiene News-letter* (Federal Security Agency, U.S.A.), *Electrical Age* (E.A.W.), *Women in Council* (N.C.W.), and a number of gas, electricity, and other "house" organs.



From Our Photo-Library—7

R. H. Shepherd

Thames Tug

(Approaching the South Bank Festival Site. During the Festival anthracite is to be provided for these and other river craft.)

CITIES WITHOUT SMOKE

A Royal Society of Arts Lecture by Dr. A. Parker

A LECTURE on “Cities without Smoke” was given to the R.S.A. at its meeting on November 22nd, 1950, by Dr. A. Parker, Director of the Fuel Research Station, D.S.I.R. The Rt. Hon. Philip Noel-Baker, M.P., Minister of Fuel and Power, was in the Chair. The lecture is published in full in the December 15th, 1950, issue of the Journal of the R.S.A.

Referring to coal consumption in this country in 1948, Dr. Parker said :

“Of the total of 190 million tons, which includes all the coal that gave rise to atmospheric pollution in this country, about 46 million tons, or rather less than one quarter, was carbonized in coke ovens, gas works, and low-temperature carbonization plants to provide coke or solid smokeless fuel, gas, tar, motor spirit, fertilizers and raw materials for chemicals. The remainder, 144 million tons, was burned as raw coal with various efficiencies, and with the production of large quantities of smoke and other polluting substances. It

included 37 million tons used in household grates, or about one fifth of the inland consumption of 190 million tons.”

A table analysing the pollution produced from different sources was given by the author and, as it is more up-to-date than that given in a report of an earlier paper by Dr. Parker (SMOKELESS AIR, No. 58, Summer, 1945) it is reproduced below. Some of the figures for sulphur dioxide are rather lower than in previous estimates, said the lecturer : those now given are based on a more comprehensive collection of analytical results for the amount of sulphur in the coals supplied.

“Since 1938,” said the lecturer, “the rates of growth in the use of coal for the production of gas and electricity have been increased by the conditions, including coal rationing, arising from the war ; while there has been a marked reduction in the quantity of raw coal burned for domestic needs, from over 50 million tons to less than 40 million

MAIN USES OF COAL AND ESTIMATES OF POLLUTION IN GREAT BRITAIN IN 1948

Type and Use of Fuel	Quantity of Coal <i>millions of tons per annum</i>	Pollution Produced <i>millions of tons per annum</i>		
		Smoke	Ash	Sulphur dioxide
Coal				
Domestic use	37	0.9	0.1	0.9
Electricity generating stations	29	small	0.2	0.8
Railways	15	0.4	0.1	0.4
Other industrial uses ...	63	0.7	0.2	1.7
Coke and Gas				
Coke ovens and use of coke	22	small	small	0.5
Gas industry				
At gas works	24	small	small	0.1
Use of gas	—	nil	nil	small
Use of coke	—	nil	small	0.3
Totals	190	2.0	0.6	4.7

tons a year. As a result, the total quantity of smoke discharged into the atmosphere was rather less in 1948 than in 1938, while the quantities of grit and oxides of sulphur were a little greater."

After referring to the distribution, detrimental effects and abatement of pollution, the author discussed efficiency of utilization of fuel, and concluded with an account of the sulphur problem, which may be quoted in full.

The Sulphur Problem

"On average, British coals and cokes made from them contain about 1.5 per cent. of sulphur. When the coal or coke is burned, most of the sulphur is converted to sulphur dioxide gas to be discharged with the chimney gases. Even with highly efficient boiler installations achieving complete combustion without unduly large quantities of air, the concentration of sulphur dioxide in the flue gas is ordinarily less than 0.1 per cent. by volume. As the volume of flue gas produced for each ton of coal burned is in the region of 350,000 to 500,000 cubic feet, the volume discharged each day from a large power station using 2,000 tons of coal a day is between 700 million and 1,000 million cubic feet. The problem of removal of sulphur dioxide, therefore is one of bringing enormous volumes of gas into intimate contact with some solvent or reagent which will rapidly dissolve or react with the sulphur dioxide to give a solution or product easily separated from the gas. Further, the process must not give rise to an objectionable liquid or solid which cannot be disposed of without causing damage or nuisance, and the overall cost must not be too high.

"The only processes that have been developed to the stage of application on a large scale are those that have been operated at the electricity generating stations at Battersea and Fulham. In the Battersea process, the flue gas is washed with Thames river water; and the solution so obtained is oxidized to convert the dissolved sulphite into sulphate. The water containing the sulphate is then discharged to the river. The process, which removes 90 per cent.

of the sulphur, is dependent on having a large volume of water containing sufficient alkali to neutralize the acid oxide of sulphur, and on ensuring that the effluent does not unduly pollute the body of water into which it is discharged. About 35 tons of water are required for every ton of coal burned under the boilers, or about 15 million gallons a day for an installation using 2,000 tons of coal a day. There are very few sites in Great Britain where the necessary quantity of water could be obtained, and where the effluent could be discharged without serious difficulty.



Sulphur Measuring Apparatus on St. Paul's

With new plant at present prices of labour and materials, the overall cost of the process is equivalent to adding about seven shillings to the cost of every ton of coal burned.

"By the Fulham (Howden-I.C.I.) process the gas is scrubbed with water to which chalk is added to form calcium sulphite, which is oxidized to calcium sulphate. From the washing water, solid calcium sulphate is separated as a sludge; and the water is re-used, with additional water to make up for loss by evaporation. In this process, though

there is little or no liquid effluent, there is a large quantity of troublesome sludge for disposal. At present prices, the overall cost of the process is equivalent to an addition of about ten shillings to the cost of every ton of coal burned.

"Both processes bring about an addition of water vapour to the chimney gases and lower their temperature. It may be, therefore, that the gases leaving the top of the chimney are not so readily dispersed and diluted in the atmosphere, and that under certain meteorological conditions there is a greater tendency for the gases to descend. These possible effects need investigation.

"Various processes that have been suggested as possibilities have been considered by a Working Group set up for the purpose by the Department of Scientific and Industrial Research; and consideration has been given to the possibilities of improving and reducing the cost of the processes used at Battersea and Fulham. One process suggested involves the use of water to which ammonia is added. By this method, the final products are ammonium sulphate and sulphur, which are of value. Investigation of this method on a small scale was undertaken over a long period by the staff of the power station at Fulham in co-operation with Simon-Carves, Ltd. The investigation has since been continued at the Fuel Research Station. Though it is too early to reach definite conclusions, it seems probable that the net cost, after allowing for the value of the products, would be in the region of the equivalent of eight or nine shillings for each ton of coal burned. A report by the D.S.I.R. Working Group will shortly be available."

The Minister

Mr. Noel-Baker, in bringing to a close the discussion on the paper, told how he had lunched that day with two very intelligent men of affairs, and

"knowing I was to come here, I asked them how many tons of coal they thought came down per annum in the form of smoke and soot on the United

Kingdom. They did not like to guess, so I said 'Do you think it's a thousand?' and one of them, with an experience of affairs, said 'Oh, about a hundred, I should say.' It is two million tons. I hope everybody will remember that and I hope everybody will remember that dirt is waste. They used to say in Yorkshire when I was young 'Where there's muck there's money'; but it was a pernicious slogan, I suppose invented by those who wanted to sell their coal in as great quantities as might be, whatever happened to it when it was sold. The truth is that where there is muck there is waste."

The Minister concluded as follows :

"The second figure I hope everyone will remember is Dr. Parker's estimate that the waste to this country per annum from the two million tons of muck that comes down on our country is fifty million pounds, more than we got last year from the export of our coal abroad. Dirt is waste and that can be saved.

"Dr. Parker spoke about Lancashire boilers. One untrained stoker can waste, in a Lancashire boiler, as much as a miner can win at the face underground—one man spending his life in the pits of Britain, doing hard, exhausting, dangerous work, and another man throwing it all away, because he is not taught how to put the coal on the fire. It can be saved. There was a 5 per cent. economy through stopping the smoke on steamers, which only happened because Hitler was going to sink them if we did not stop it. It cost three and a half pounds of coal per unit in electrical power stations twenty years ago; it costs one and a half today. Huntley & Palmers took one of our mobile testing units from the Ministry, they applied the tests to all their different departments and, in summer, they closed down two boilers out of three and in winter one out of three. Another firm insulated the roof of a big factory and saved six hundred and twenty-five tons of coal a year, and paid for the cost of the insulation of the roof in three and a half years."

NEWS

FIRST SMOKELESS ZONE IN BEING—COVENTRY'S DISTINCTION

Britain's first smokeless zone, a 30 acre area in the centre of Coventry, came into being on March 1st, 1951. There had earlier been some doubt about whether a postponement might be necessary, but in view of the fact that the small amount of bituminous coal used in the area had considerably decreased since the zone was planned in 1947, it was decided to proceed.

170 of the 179 premises in the area are of a business nature, with only a few caretakers' flats and other domestic premises. Since the plans for the smokeless zone were made in 1947 there have been many inquiries and requests for advice from those using bituminous coal in open grates. 35 per cent. of the total bituminous coal consumption went for example when a large bank in the area changed over to anthracite.

The Coventry Act under which the smokeless zone has been set up allows for extensions, and ultimately it is hoped that the whole city will be covered. The authorities do not, however, anticipate any great extension within the next few years.

SALT WORKS AT STAFFORD

An interesting story of a smoke problem, action against it, and the sequel, comes from Stafford. Complaints from householders led the Stafford Council to serve an abatement notice on the local salt works. The firm stated that the cost of complying with the notice would be so high that they might have to close the works instead. Thereupon the 200 workers affected presented a petition, which was supported by the Trades Council, calling upon the Town Council not to take any steps that would endanger their livelihood. The Public Health

Committee agreed to take no action until they had considered reports of observations to be taken during the following three months.

During this time an investigation of the problem was made by a Fuel Efficiency Engineer of the Ministry of Fuel and Power, Mr. F. Horne. According to the *Birmingham Gazette* (January 29th, 1951) he had advised the use of thinner fires. "I think the answer may be as simple as that," he said. "The procedure for firing salt pans has been the same for very many years. They have been using fires up to 2 ft. 6 in. thick, but neither management nor workers could give me any technical reason why.

"I think when the system first started lump coal was used, and they have retained the method of firing, although the coal they get now has a different ash content, calorific value and coking characteristics. With this coal a six to nine inch fire should be just as efficient, provided it is kept level over the whole grate and not too many fire holes connected to the same chimney are fired consecutively.

"A stoker and I spent a day firing nine furnaces like this. It was quite satisfactory from the points of view of both salt-making and smoke. If they fire as we suggest they will make as much salt with far less fuel, and not make enough smoke to cause a nuisance."

Following this a meeting took place between Mr. Horne and representatives of the salt works managers and workers, union leaders and members of the Stafford Town Council. A director of one of the works said, "We are very optimistic. Everyone is in the right spirit and ready to help." A trade union official said that if shown the way the salt workers would co-operate in any new methods, and if necessary foremen could form a school to teach the new methods.

WORKINGTON REPORT

We congratulate the Workington Grammar School on an excellent and



SMOKE SCREEN ROUND UNO

A view of Manhattan with smoke pouring from the Consolidated Edison power station (centre), and the New York Steam Company (right) towards the United Nations Headquarters building, the tall glass-faced (!) building on the left.
Photo from "New York Herald Tribune," by kind permission.

most enterprising piece of work. This was a survey by the 2nd Year 6th form on the town's smoke problem. A report has been published, with photographs, which shows how the work was organized by the Survey Group dividing itself into sections. The sections were biological, geographical, editorial, meteorological, photographic, and mathematical and statistical. This indicates the kind of approach made and the numerous aspects covered. The team found that pollution in the town was surprisingly low—140 tons per square mile per annum—and that this was probably kept down by the south west winds and steady rainfall. "The real culprit," concludes the report, "is the domestic chimney."

NEW YORK CITY SMOKE CONTROL

New smoke prevention regulations went into force on October 1st last, under which prior approval of all new fuel-burning plant is required, and coal to be used in hand-fired equipment must not contain more than 24 per cent. volatile matter. On approval of an installation a permit is issued for which the owner pays a fee ranging from 2 to 200 dollars. The Bureau of Smoke Control is now a part of the Department of Housing and Building instead of the Health Department. Penalties may be imposed against shipping, and the *Queen Mary* has been observed to be producing more smoke than is now permitted.

Correspondence

River and Air Pollution

*The Editor,
Smokeless Air*

Sir,—Members of the Society will have seen references to the Bill now before Parliament for preventing river pollution and giving stronger powers to the new River Boards. I wonder if the position of “checkmate” which has existed so long with atmospheric pollution might not be overcome in a similar manner to that of rivers’ pollution, *i.e.*, by removing the enforcement of the law from the hands of interested parties through the establishment of *Regional* Smoke Prevention Boards. It is clear that the rural districts surrounding industrial cities stand to gain by elimination of smoke they now receive from the cities, and consequently they should have a say in the matter.

To judge from chimneys in Yorkshire, black smoke is emitted for long periods from a large proportion of the industrial plants, and it should not be difficult to save the (relatively) small quantity of coal needed to tide the country over the present emergency. Cities of 3 to 400,000 inhabitants are completely without Smoke Inspectors.

I should like to know the views of other members of the Society on this.

Yours, etc.,

G. B. BATES.

East Ardsley, nr Wakefield.

District Heating and the New Towns

*The Editor,
Smokeless Air*

Sir,—I trust you will find room for this letter in reply to Mr. C. A. C. Turner’s contribution to the proceedings at Margate. In his paper, Mr. Turner’s approach to the problem of Smoke Prevention seemed to show an open mind on the question of district heating, but his final contribution contains many misconceptions,

and his conclusions I challenge as being either inaccurate or misleading.

It is quite evident that whatever calculations Mr. Turner has based his statements on can apply only to the particular schemes he has examined. The schemes or the area may not have been suitable, but that only demonstrates the “paucity” of his information, as some other schemes point to entirely opposite conclusions.

There are many areas in the U.S.A. where climatic conditions are similar to, and require less heat than, the South of England; and the Americans have found district heating systems economical even in these areas.

Mr. Turner now states :

1. “In this country we can do with so little heat, that sufficient can be obtained with a relatively small outlay.”

The total cost of heat and hot water in this country is not small, even to domestic premises. The actual consumption of fuel for heat in domestic premises alone, reckoned in terms of total coal used as solid fuel, and through gas and electric appliances, averages over $4\frac{1}{2}$ tons per family per year, and that does not include anything for public or commercial buildings or for industry.

The average *cost* per family is now about 11s. per week and if public and commercial buildings and industry are included the cost per family is certainly nearer £33 per year, or nearly 17s. per week, not I suggest an inconsiderable portion of the cost of mere existence in this supposedly temperate climate.

2. “The capital cost of district heating must be incurred in its entirety before the schemes can be put into operation.”

Again incorrect. A scheme can be planned to grow from small beginnings, to coincide with the development of the area.

3. “District heating must be considered in dual capacity of heating and hot water service, and heavy mains losses in hot water service render individual appliances far more economical.”

On a very scattered layout, admittedly

heat losses would be high, but this is obviously not a case for a District Scheme; gas or independent coke boilers would, in such a case, be more economical, but we are discussing New Towns, not a collection of villages or scattered hamlets. Towns will have one or more comparatively fairly closely built up areas, probably also including a proportion of flats and terraces, plus schools and Commercial and Industrial premises.

The issue is whether an efficient centralized scheme would give more and cheaper service and use less fuel than a few thousand indifferently stoked individual appliances, using a more expensive fuel. I say that properly designed and in many suitable areas it would be far more economical.

4. "Humidity of English climate makes high temperature heating uncomfortable and less acceptable, and in consequence English schemes are run at lower temperatures topped up by electricity."

Excessive humidity is a curse and responsible for many ills. Heat is essential to prevent damp and maintain the moderate temperatures generally needed in this country. It is notorious that we have the coldest, draughtiest and dampest homes in Europe. If adequate, not excessive, but simply adequate heat is given from a central source, there will be less of the undesirable topping up by electricity.

5. "The inevitable minimum running costs compare unfavourably with modest household budgets."

This is simply not necessarily the case. The running costs can be less than by individual methods, even in the south of England. A *high* standard of heating cannot be obtained "on the cheap" as I have said above, even a low standard is costing about 11s. to 12s. per week per family. There is nothing "inevitable" in this matter if architects, town planners and engineers will co-operate.

No one in his senses would claim that district heating is capable of universal application, but there are many areas where a little forethought

and correct planning would enable it to be the most economical form, in capital, operating expenses and in fuel consumption. To sum up, there are suitable spheres for all methods, but the one Mr. Turner rejects has been insufficiently considered and *never yet had a fair trial in this country.*

Yours, etc.,

DONALD V. H. SMITH.

Harpenden, Herts.

Industrial Locomotives

*The Editor,
Smokeless Air*

Sir,—Adverting to the discussion on "railway smoke" at the Margate Conference, my remarks regarding industrial locos, and those of two subsequent speakers regarding (a) the use of fireless steam locomotives and (b) Board of Trade regulations requiring driver and fireman on the footplate. I have now had the opportunity of considering these suggestions and wish to offer my conclusions.

Locomotives used in the heavy industries perform very heavy work, and in many cases (particularly the one I have in mind) cover a wide area. Steam supplies "on tap" would be required at widely dispersed points inside and outside the works. This is impracticable and would be uneconomic if only by reason of the lengths of ducts and prevention of condensation.

On the second point, Board of Trade regulations in regard to driver and fireman do not apply inside industrial plants. The reason is, apparently, the regulation* under the Factories Act, 1937 dealing with locomotives and requiring a second man, apart from the driver, to accompany a train of waggons under certain circumstances. In an integrated steelworks this means a driver and a second man (not on the footplate) for most of the time a locomotive is on duty inside the works' area. The driver is, therefore, invariably alone on the footplate. To fire "little and often" under such circumstances is impracticable and would, in

(concluded, page 123)

Gas Coke

By J. O. Cooke and A. C. Hutt

COKE is the carbonaceous material remaining after the volatile matter, *i.e.*, tar and gas, etc., has been removed from *certain* types of coals by heat treatment. This carbon is left in a form that makes an ideal fuel because it is completely combustible and entirely smokeless.

The gas industry today carbonizes about 25 million tons of coal per annum and produces for sale about :—

428,000 millions cu. ft. of gas.
9 million tons of coke.
1½ million tons of coke breeze.
1¼ million tons of tar.
70,000 tons of sulphate of ammonia.
64,000 tons of benzol.
35,000 tons of sulphuric acid.
and many other by-products.

The gas and the coke together make up by far the greatest quantity of smokeless fuel sold in this country.

Gas coke was first produced when, in 1792, coal was carbonized to produce gas which was stored in gas holders and piped to houses for lighting.

The process of carbonizing coal in gas works comprises baking the coal in enclosed ovens called retorts which are kept at a red heat for about 12 hours during which time the coal is converted into a cake of coke and gas is distilled off in the form of a thick brown smoke commonly termed crude gas. This crude gas contains tar and many valuable by-products, the value of which was not appreciated in the early days of gas making.

The crude gas is cooled by passing through condensers, nests of pipes cooled by air or water passing round them, in which the tar and water vapour are condensed.

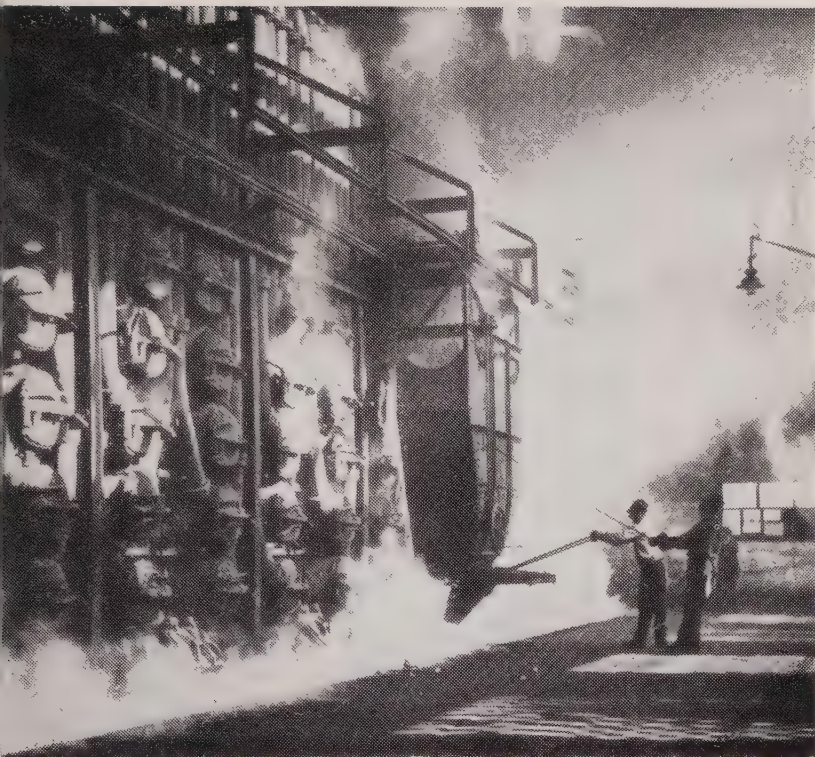
After passing through the condensers the gas is pumped by an exhauster which draws it from the

retorts and forces it through the chain of purifying plants until it reaches the gas holder and pushes up the sections until the holder is full. The exhauster can be called the heart of the gas works as it never stops day or night.

After passing the exhauster the gas is often re-cooled in more condensers and passed to a tar extractor, the "Livesey," where final traces of tar are collected by bubbling the gas through gauze under water. The ammonia is next removed from the gas by dissolving it in water in towers called "scrubbers" or in rotary machines called "washers." In the latter, wheels of brushes are kept wet with water or ammonia solution and the gas is passed over the wet surfaces. The next impurity to be removed is sulphuretted hydrogen of which no trace is allowed to remain in the finished gas. This is done by passing the gas through a series of large boxes containing layers of oxide of iron. By chemical action the sulphuretted hydrogen is decomposed leaving pure sulphur mixed with the oxide. When there is sufficient sulphur in the boxes the material is removed and used to make sulphuric acid.

Often the gas is then washed with oil to extract benzole and naphthalene. It is usual too, in many works to wash it once again with a solution of calcium chloride to remove any water vapour which might condense on cold days in the consumers' pipes. The gas is then measured in large meters and stored in gas-holders ready to meet the fluctuating demand of the gas consumers, which is high at midday dinner time and low in the early hours of the morning. From the gas holders the gas is passed through an automatic tap, the station governor, which regulates the pressure of gas to the consumers.

Since the early days of carbonizing



Coke being discharged from horizontal retorts

coal vast strides have been made in producing clean gas of a uniform heating value. The by-products recovered in this process primarily comprise coke, tar, ammonia, benzol and sulphur. The sulphur is made into sulphuric acid; benzol is an essential solvent used in the production of all rubber goods and is also used as a motor fuel. The ammonia is converted to sulphate of ammonia fertilizer, the use of which vastly increases food production. The products obtained from the crude tar include creosote, used as a wood preservative and as a fuel, many medicinal products, disinfectants, practically all local anaesthetics, many dyestuffs, explosives, road tar, saccharine, electric insulating materials, resins, plastics, adhesives, and perfumes, etc. A full story of the uses to which these by-products are put could be quite fascinating.

All these valuable materials are lost in the form of smoke when raw coal is burnt in a fire or furnace. It may seem difficult to believe that beautiful dyes and perfumes originate from coal, or that we would get much less milk were it not for the fertilizers produced from coal carbonized in gas works.

Coal was originally carbonized in what were termed horizontal retorts. These comprised a battery of fireclay tubes about 22 inches by 18 inches and up to 20 feet long. A greatly improved type of horizontal retort is widely used today and a modern retort house may have 20 to 300 retorts of this type, each of which holds 10 to 17 cwt. of coal according to size. They are heated by coke-fired producer furnaces. These generate producer gas which is mixed with air and burns in flues between the retorts. A horizontal ram, or stoking machine, pushes a charge of coal into each retort and pushes

the coke out after carbonizing. The red hot coke is generally cooled by dropping it into a trough of water.

For many years all retorts were somewhat of this type but in more recent years vertical retorts have been evolved and are being increasingly used for new gas works installations. These retorts are usually 15 to 25 feet high and are oval or rectangular in cross section, of any size between 30 by 15 inches to 108 by 15 inches. There is a coal hopper or box at the top and a similar coke box at the bottom, and the coke slides through by gravity. Such retorts treat 3 to 10 tons of coke each daily and in one retort house there may be 100 retorts.

The continuous vertical retort is one in which coal feeds continuously down the retort and the coke is continuously discharged from the bottom and quenched and cooled by steam. This type of retort has the advantage that it requires less labour than other types and therefore the production cost is a little lower.

The intermittent vertical retort is one in which the retort is fully charged and carbonized and then completely emptied and charged again. The type of coke

produced from horizontal and intermittent vertical retorts is very much the same but the coke from the continuous vertical retort has the special characteristic that it is a lighter coke and occupies more space. This last coke has a lower bulk density and is also more reactive, a feature which is referred to later.

After coke has been quenched to cool it, it is discharged on to an elevator which raises it to a screening plant comprising a series of reciprocating or vibrating plates about 3 to 5 ft. wide by 10 to 15 ft. long. The plates are perforated with different size holes and the shaking motion moves the coke slowly along the screen. The first screen usually has $\frac{3}{8}$ to $\frac{5}{8}$ inch holes and screens all fine material below $\frac{5}{8}$ inch which falls into a hopper below. The coke then passes over the other screens which separate the $\frac{1}{2}$ inch to $1\frac{3}{4}$ inch boiler nuts 1 to 2 inch coke and the large coke over 2 inches.

If market requirements call for a greater quantity of the smaller sized coke, the large is "cut," that is it is passed through a special type of crusher which breaks it down in size; this material is then screened into the smaller sizes.

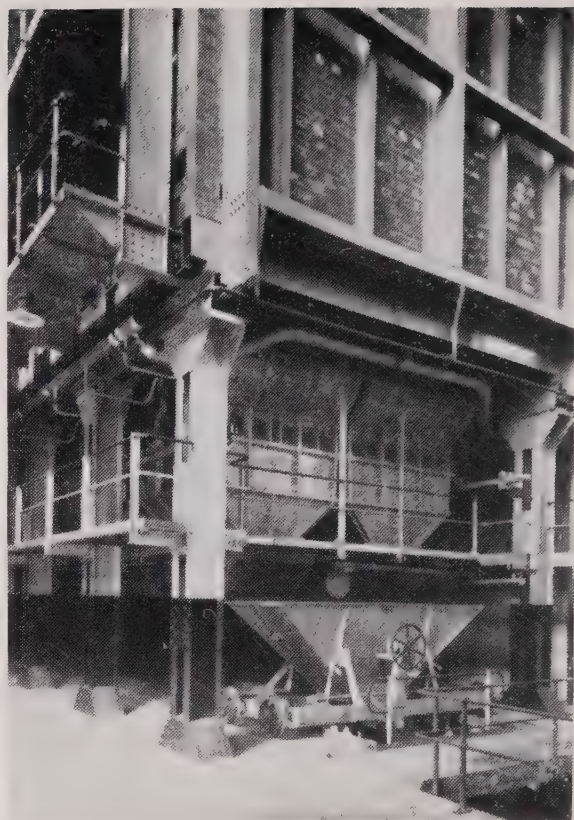
Characteristics of Coke

The principal characteristics of coke is its smokeless combustion, the reason being that, as has already been explained, all the volatile constituents in coal which cause smoke, such as tar, etc., have been removed in the carbonizing process. Also, as has already been stated, these volatile constituents in coal are the source of valuable by-products in everyday use which are just wasted when ordinary coal is burnt.

Other characteristics affecting the quality of coke as a fuel are its heating value, type of coal carbonized, size grading to suit particular appliances, moisture and ash content and reactivity. These items will be dealt with separately.

Heating Value of Coke

The calorific value of coke as determined in the laboratory is about 12,000 British Thermal units per pound but this is not all the story.



Discharge end of vertical retorts

When burning coal, in many appliances heat is wasted because some of the substance of the coal is given off as smoke without being burnt. When burning coke, this waste does not occur and as combustion in the firebed is more complete the radiant heat efficiency is much greater. This is confirmed by official tests in which some types of domestic heating appliances, for instance, a modern open fire, gives 30 per cent. more effective heat when burning coke than that obtained when burning the same quantity of house coal.

The rough overall ratio of the thermal efficiency of coke to that of coal is 5 to 4, although greater difficulty is experienced in reaching an efficiency of 40 per cent. with coal in openable stoves with boilers than in reaching an efficiency of 50 per cent. with coke in such appliances, even when the stove is new and the heated surfaces are not fouled with soot and tarry matter. This gives an indication of the relative values of coke and coal in such modern appliances. Assuming the calorific value of average household coke as

determined in a laboratory to be 9/10 that of average household coal then the relative value of coke when compared with coal is 9 to 8. That is, from the standpoint of the useful heat obtained, 1 ton of coke is equal to 22½ cwts. of coal, or stated another way, if house coal costs 90s. per ton then properly graded coke of reasonable ash and moisture content is worth 101s. per ton to the householder.

Type of Coal Carbonized

The characteristics of coke differ somewhat in relation to the type of coal carbonized. Gas companies used to be able to order the coal they considered most suitable for carbonizing under their particular conditions, but now undertakings often have to take the coal allocated to them and this frequently adversely affects the coke quality.

Size Grading

The best and most efficient result is obtained from fuel in any appliance if the size of fuel used suits that particular appliance. During the last twenty years the greater part of the Gas Industry has adopted and brought into operation a system of size grading as follows :

it is loaded for delivery to the customer. This, however, is not always possible when dealing with heavy demands during a cold spell.

Ash Content

When coal containing ash and shale is charged into a retort and carbonized the same quantity of ash is bound to remain in the coke.

Coal contains about 3 per cent. inherent ash, that is ash in the structure of the coal itself. In addition, coal now contains 4 or 5 per cent. of extraneous ash in the form of shale. This is stone or other matter from the outside of the coal seam which is cut and loaded with the coal. It is this extraneous shale which has increased considerably in recent years due to the introduction of coal cutters and to less care being taken for its removal at the pithead.

The result of this is that coal now contains a total of 7 to 8 per cent. of ash and coke about 10 per cent. As the shale or stone is mostly in small pieces it is mostly screened out with the boiler nut size coke and as a consequence boiler nut size coke may contain 12 per cent. of ash and large coke only 8 per cent ash.

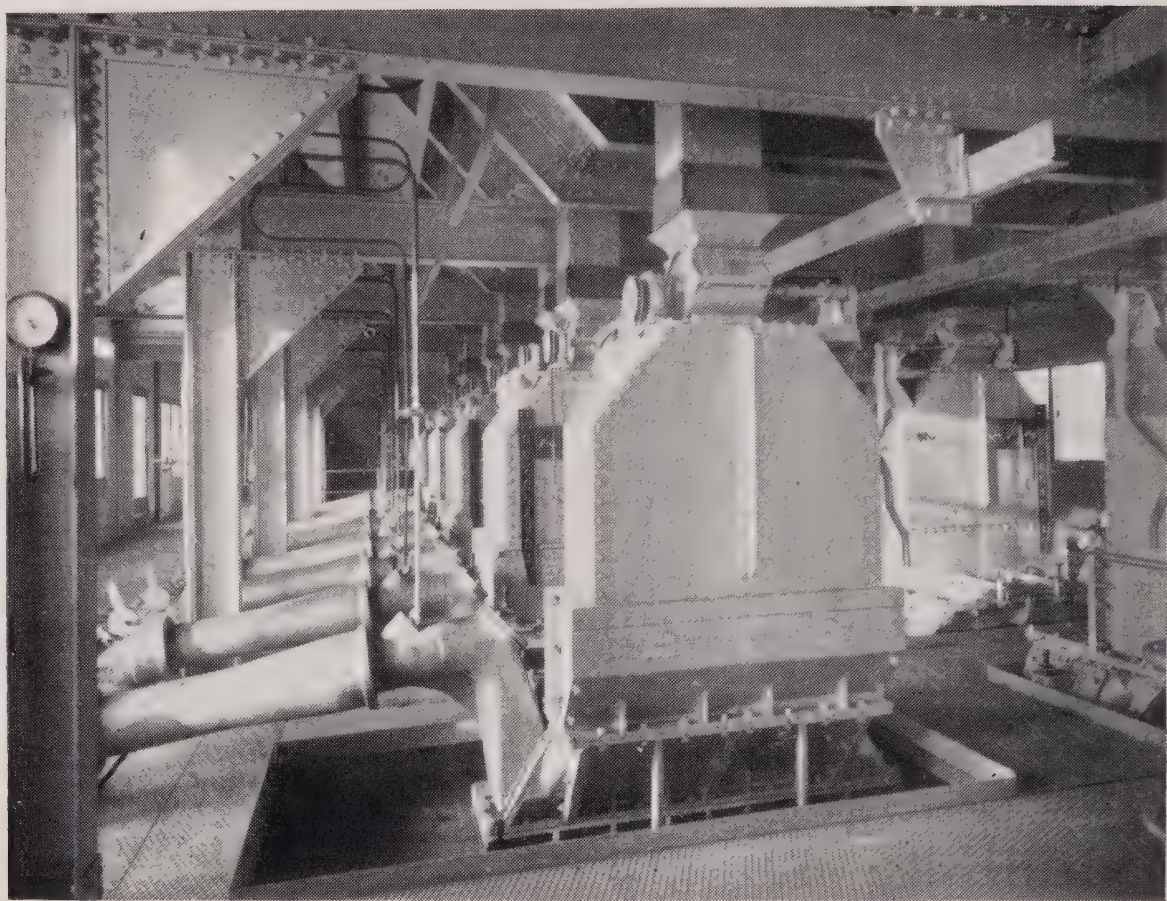
Some gas undertakings have started

<i>Name</i>	<i>Size</i>	<i>Usage</i>
No. 1 Large ...	over 1¾"	Industrial and large central heating installations
*No. 1a Large ...	1¾"—3½"	Industrial and small central heating installations
No. 2 Broken ...	1"—2"	Industrial, small central heating and domestic stoves
Open Fire Coke ...	1"—2"	Particularly suitable for open fires
No. 3 Boiler Nuts ...	½"—1¼"	Domestic Boilers
*No. 4 Forge Beans	¾"—¾"	Forge work and chain making
*No. 5 Automatic Stoker Fuel ...	⅛"—¾"	For some automatic stokers
Coke Breeze ...	under ¾" or ¾"	Industrial purposes

* These sizes are not produced in all gas works and the quantity available is limited.

Although coke may be well screened and sized in the first place, it is friable and when it is stock piled for winter use, this may cause considerable breakage and the coke will be undersize. In many works coke is re-screened before

cleaning coke to remove the extraneous ash or shale, but even if the large quantities of cleaning equipment required could be made it should rightly be installed to clean coal at the pithead and not in the gas works.



Charging hoppers of vertical retorts

Moisture

It is desirable to have 4 to 6 per cent. moisture in coke, otherwise it is very dusty, and when dry coke is handled particles break off and blow about. Active work is in progress to ensure that moisture content of coke is kept within desirable limits.

Reactivity

Coke is of course less reactive than coal. This means that whereas coal will burn down to a low temperature and rate of combustion, coke will die out at a higher temperature than coal. Coke also requires more heat to raise it to the higher temperature required to ignite it. This low reactivity of coke is no disadvantage where coke is used for industrial purposes, but for domestic use, greater reactivity is desirable to enable coke to remain alight at a low rate of combustion for longer periods. Considerable progress has and is being made in producing more reactive coke for domestic purposes.

Future Quality of Coke

The gas industry is alive to the deterioration in coke quality when compared with the coke produced before the war. This deterioration is due to the inferior quality of coal now supplied to the gasworks for carbonizing and, to a lesser extent, to the fact that it had been impossible to replace much old and worn gas works equipment. Increased demands for gas and coke have also resulted in coke screening plant being overloaded above its efficient working capacity. In 1946 a section of the Gas Industry set up a Committee to examine and report on all the aspects of Coke Preparation and to specify a desirable standard of coke quality. The Committee is continuing its work under the Gas Council and is being pressed forward today as a matter of outstanding importance.

No startling new methods of improving coke quality are to be expected. Solution of the problem depends on getting better coal and being able to

obtain new and better equipment. Whilst improvement in coke quality is important, the greater need today is for the supply to individual users of coke of more uniform quality.

A very large tonnage of the coke now being produced is of high quality and steps are being taken to bring all coke produced up to this standard. Uniformity in both grading and quality is of vital importance to each user whether domestic or industrial. At present three or four different coals may be delivered to a gasworks within a relatively short period, and the coke produced from each will probably be a little different.

Then again a gasworks may have a battery of horizontal retorts and also a new and up-to-date battery of continuous vertical retorts. They may produce equally good coke but their burning characteristics will be slightly different and the user is naturally irritated if he receives a delivery of one coke today and the next delivery is something a little different. Therefore, those concerned are endeavouring to ensure continuity of deliveries to any one customer of coke of uniform quality, or of similar burning characteristics.

Coke Burning Appliances

Coke quality cannot be judged except in relation to the appliances in which it is used. In some appliances coke gives a better and more efficient performance than can be obtained by any other fuel; in other cases the appliance does not suit the fuel and the result is not so good. For some reason which is not quite clear it is generally the fuel which is blamed whereas more often than not the fault is that the appliance is badly installed, is unsuitable for using coke or is not properly operated. The Gas Industry have had a number of coke research laboratories working for many



Stockpiling coke for winter supply

years with the most up-to-date equipment, where tests are constantly and continuously being carried out on new types of appliances. All the initial work in developing the modern high efficiency open coke fire was carried out at these laboratories. These open coke fires have gas ignition and give considerably greater effective heat output than any coal fire burning the same quantity of fuel.

Standard tests carried out in the Gas Industry Laboratories on manufacturers' new prototype appliances are recognised by the Ministry of Fuel and Power as a basis for approval for fitting such appliances in new houses.

Sales and Service

Gas coke is sold either directly by gas undertakings or through merchants in either case the price to the consumer is the same. The Gas Council have an organization for moving coke from any area with a surplus to another area where there may be a shortage. There is a close liaison between the Gas Industry and the merchants. In the southern area this operates through the London & Counties Coke Distributors' Association and a Coke Sales Circle which embraces the Merchants' Sales

Staff and the Coke Technical and Sales Staff of the Gas Industry. At regular meetings papers are read and matters discussed concerned with sales, service and all matters with the distribution and efficient use of coke.

The Gas Boards all have in being, or in the course of formation, a Technical Service staff to deal with any enquiries concerning the use of coke. The Gas Council Technical Staff have specialists in various branches of fuel utilization and their services are available through the Gas Boards to distributors and users in dealing with enquiries concerning central heating in large buildings and factories, steam raising installations, industrial heating, and other large scale heating installations.

Possibilities of increased production to meet Simon Report requirements for Smokeless Fuel.

Gas coke production has increased from about 7 million tons in 1939 to 10 million tons in 1950. Only about 2½ million tons of this is used today in the domestic market. While the present production would not be adequate to replace all the coal now used in the domestic market, it will be adequate to meet the needs for some years, and will certainly provide an increased supply sufficient to meet the needs of smokeless zones at the rate the statutory powers are likely to be brought into operation. The increase in rate of production of smokeless fuels will probably also meet the fuel requirements of all the new modern domestic heating appliances for smokeless fuel which manufacturers are likely to produce in the next few years.

Coke Storage

In order to provide for the domestic market the gas industry has to build up stocks of coke over the summer months amounting to about 1¼ million tons to meet the needs for heating in the cold winter months. The transport of coke to the storage dumps, unloading and reloading when required for delivery to customers in the winter is quite an expensive operation.

In the one or two coldest winter

months, gas works and fuel distributors receive orders for six to ten times the quantity of coke and coal that is ordered in summer months. It is obvious that they could not maintain an idle staff and vehicles for 10 months in the year to meet this heavy demand in two cold winter months. It has been usual in the past to hire additional transport to meet this heavy demand but the present shortage of transport vehicles and the very high cost of new vehicles presents a serious problem. The obvious answer is that adequate fuel storage space should be provided in all new houses and that all who have storage space should take in as much fuel as possible during the summer months.

Industrial Locomotives—*continued*

fact, be dangerous. Any suggestion that a fireman be permanently provided is an uneconomic one. In the journal of the Iron and Steel Institute, December, 1950, page 355, figures are given indicating how costs per locomotive in steel works are derived. Wages of drivers, cleaners and holidays with pay equal 52 per cent. of the total costs.

My original opinion still remains—that the only solution to the locomotive smoke problem in the iron and steel industry (and other heavy industries) is conversion to diesel. I have good reasons to believe that this is confirmed by the attitude of managements to transport costs. It will, however, be a very long time before coal fired locomotives in industry are in the minority.

Yours, etc.,

G. H. WILKINSON,

Chief Sanitary Inspector

Corby, Northants.

Mexican Donora—The *New York Times* reported a poisonous refinery smog over a suburb of Poza Rica, Eastern Mexican oil town, resulting in the deaths of fifteen persons, and illness of others, on November 24th, 1950.

Smoke Prevention Abstracts

169. Survey of Respiratory Illness in a New Industrial Town. Sutherland, I., and Wilson, D. C. (Public Health, Dec., 1950, 64(3), 17-21). A survey has been made of respiratory illness in the new industrial town of Corby, Northants (14,000 pop.) The six general practitioners with patients in the area collected records of all cases of respiratory illness (excluding colds, influenza, tonsillitis) seen for the first time during a fortnight in the late spring and a fortnight in the late autumn of 1949. There were 117 cases during the four weeks. The incidence of respiratory illness among women aged 15 to 44 was double that reported by men. There was a considerably higher incidence of bronchitis and pneumonia, but much less asthma, than in a Scottish semi-rural practice. There appeared to be an association between weather conditions and the incidence of respiratory illness. The possibility was investigated that the heavy pollution of the atmosphere from a nearby steelworks was a factor leading to respiratory complaints. An unduly large number of respiratory illnesses was seen 2 to 3 days after heavy fog. This may be attributed to the joint effects of fog and pollution, but the relative importance of the two influences cannot be assessed on the data available. It is concluded that the method of survey, involving co-operation between general practitioners, medical officers of health, an institute of social medicine, and others, should enable fresh attacks to be made on many problems of public health.

170. Automatic Furnace Combustion Control. (Brit. Steelmaker, Nov., 1950). A system which is claimed to eliminate all smoke nuisance is operating successfully at the Wadsley Bridge (Sheffield) Works of Clay Wheels Rolling Mills Ltd. The system, evolved by Mr. Herman Lindars, managing director of Dunford and Elliott Ltd., Sheffield, is being used on three coal-burning furnaces used for billet heating, each of which is controlled automatically and remotely. Thermostatic control governs the supply of forced draught to the furnaces, and if the furnace temperature falls, more air is admitted, and conversely. All qualities of alloy steels are being handled satisfactorily with the aid of the new device, a leading advantage of which is claimed to be a 25 per cent. economy in fuel. Other advantages include a significant increase in the life of furnace linings and accurate

control of furnace atmosphere, thereby reducing scalding of billets.

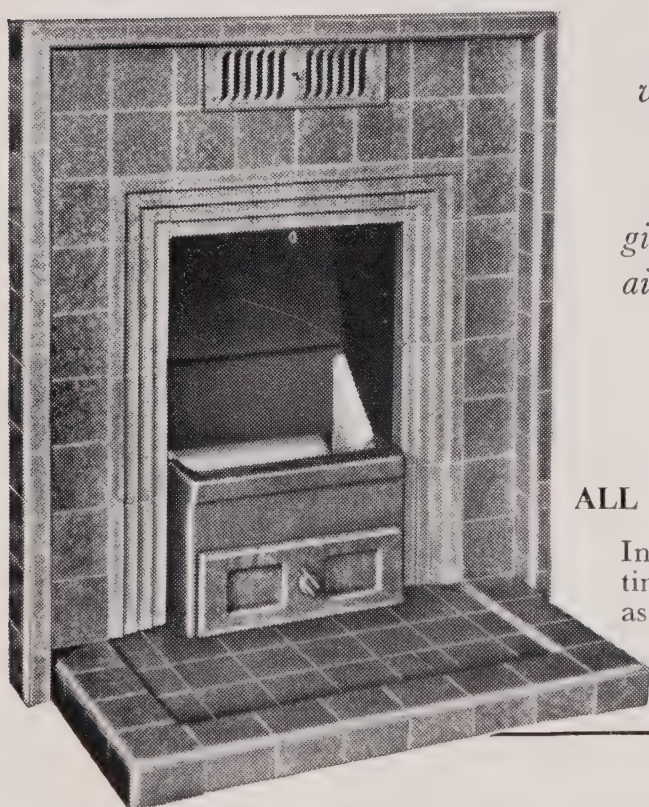
171. Current Research by Ministry of Fuel and Power. Cox, Roxbee. (Engineering, 19 Jan., 1951). Abstract of address to Coal Industry Soc. References were made to underground gasification and to use of gases averaging 75 B.Th.U. per cu. ft. in the gas turbine, which could in fact be made to work on still more feeble gases. A gas turbine was being made to burn weak mixtures of methane in air, which were available at all collieries. Otherwise unusable coals might also be burned at the pithead with the coal-burning gas turbine. The speaker discussed the heat pump being installed in the L.C.C. Concert Hall on the South Bank Festival site. This would use low grade heat from the Thames to heat the hall, and in hot weather it would run in reverse, acting as a refrigerator, and cool the hall. Its motive power was 2 Rolls Royce Merlin aircraft engines running on towns gas, and it would supply one and a half times as much heat as was in the gas used. The conventional alternative means of using the gas would only supply about three-quarters of the heat in the gas.

172. Portable Continuous Smoke Recorder. Brand, E. K. von. (Heat vent., June, 1950, 47, (6), 87-89; Mech. Engr., June, 1950, 72 (6), 479). The continuous recorder described has sufficient accuracy and versatility for continuous smoke measurements on small installations, especially domestic oil burners. Is based on principle of filtering a known volume of flue gas to obtain a soot deposit on a filter; the optical density of the deposit is then a measure of the smoke content of the entire gas stream. A continuous trace of smoke deposits is produced on a filter tape by pulling the tape through a specially designed fixture interposed in the gas stream which is drawn continuously from the stack by a vacuum pump. The tape is kept moving by rolls geared to a synchronous motor to ensure uniform speed. The varying degrees of darkness of the trace furnish a measure of the smoke conditions, and a suitable time scale marked on the tape as it passes through the instrument shows the rate of change of smoking. Typical records are given and reveal how the instrument can be used in detecting faults and troubles in various fields of combustion. (Inst. Petroleum).

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*Hot water and two kinds of
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*The boiler model
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AND

*give background warmth by convected
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2,000 cu. ft.*

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ALL FOR 1½-2 CWT. OF FUEL A WEEK

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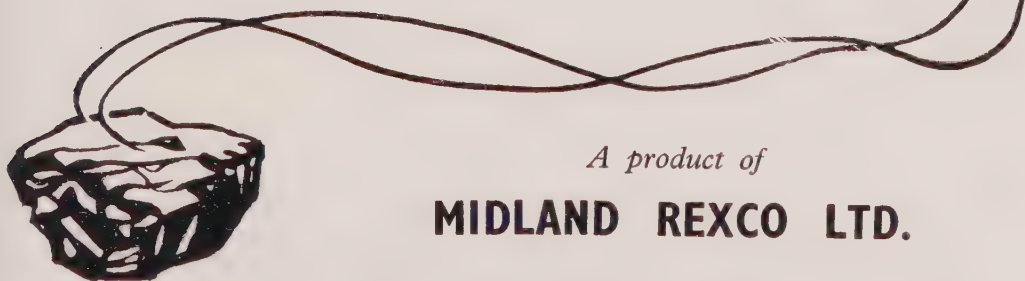
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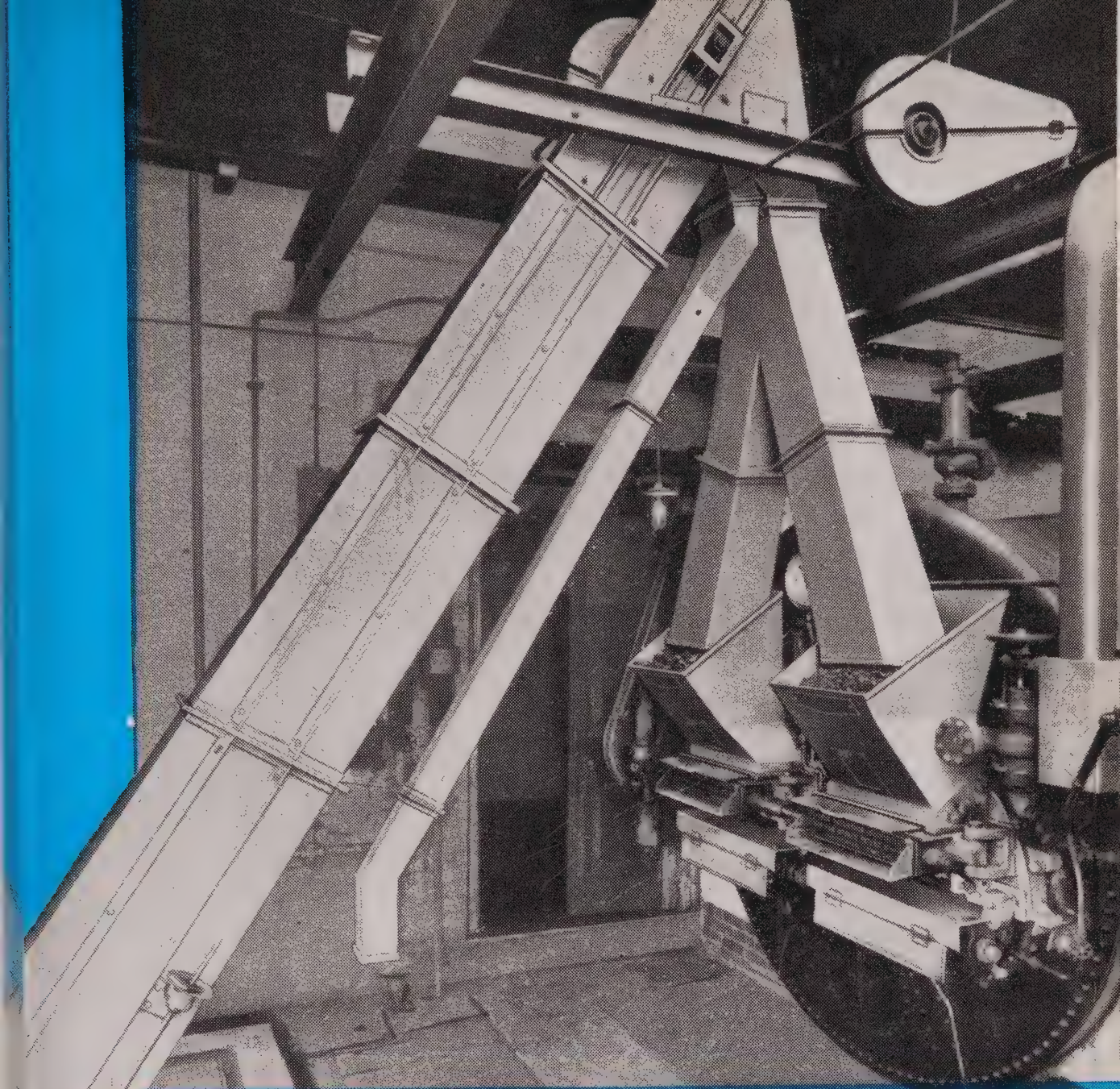
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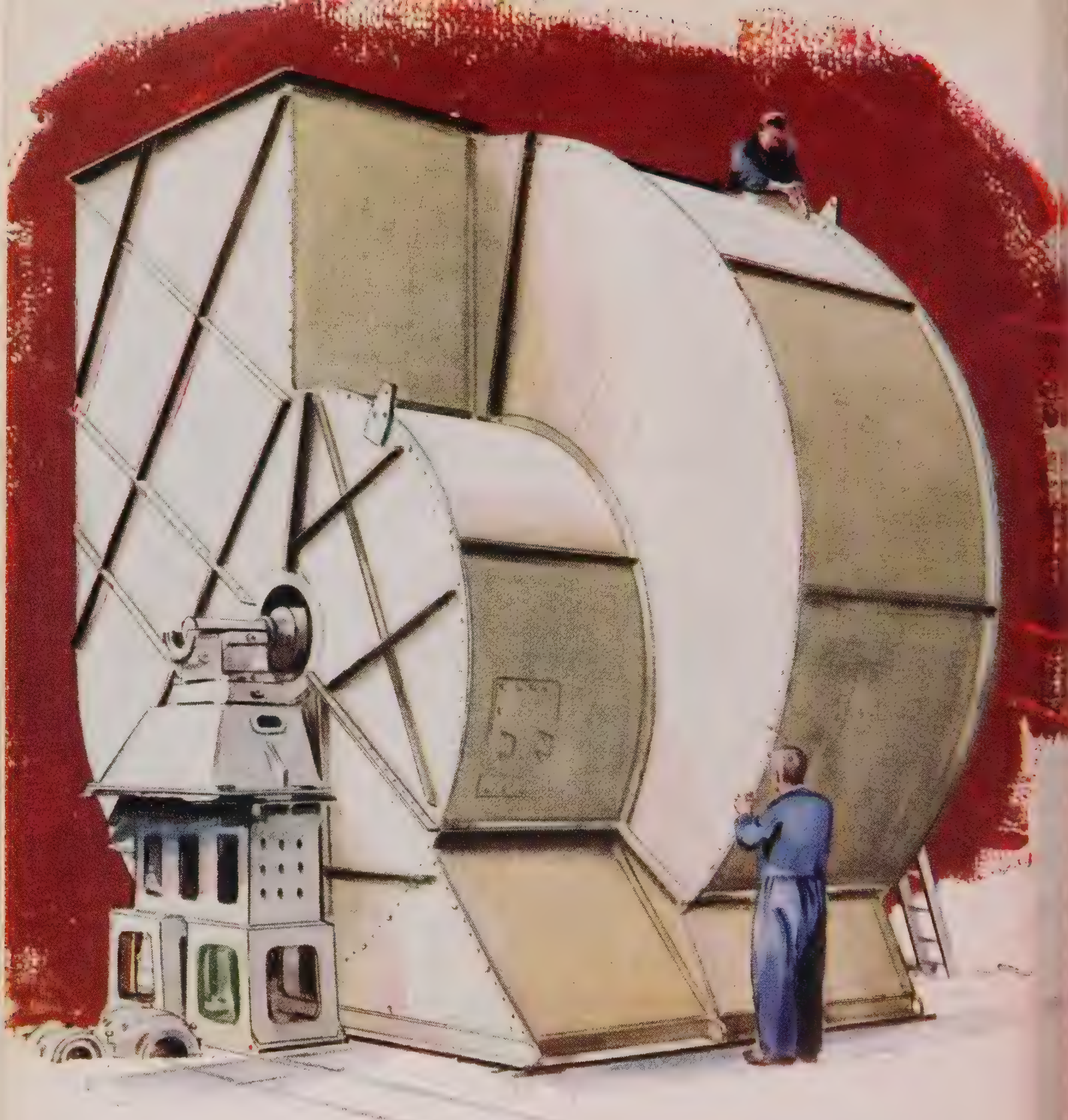


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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 78

SUMMER

1951

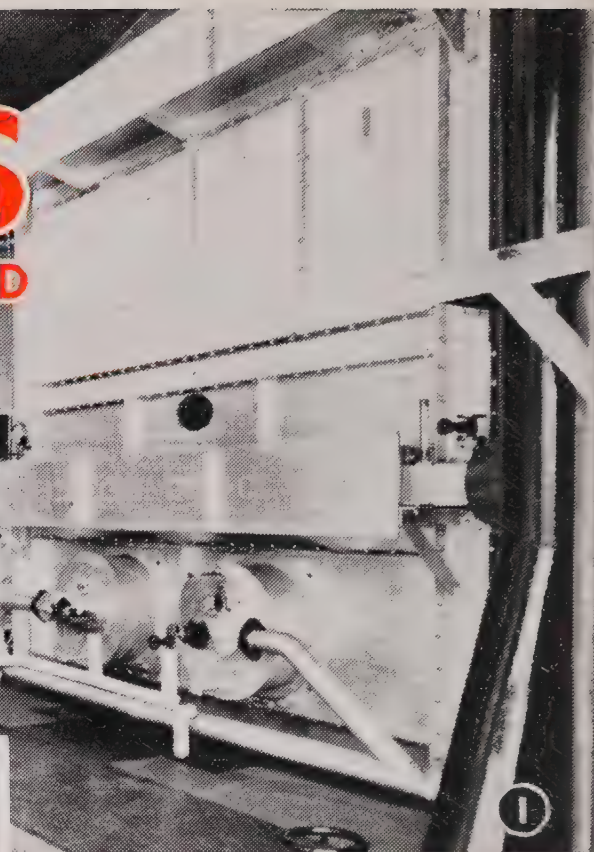
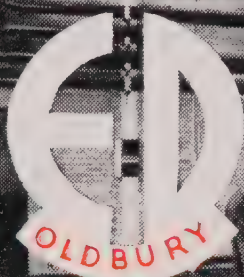
ONE SHILLING

In this Issue

A Hundred Years of Smoke Prevention
Parliament Discusses Smoke
Colliery Spoilbanks. The Rexco Process
Railways without Smoke
Smoke Abatement and a National Fuel Policy

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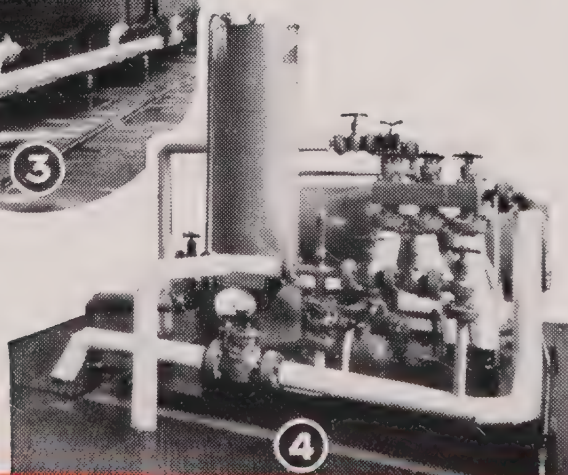
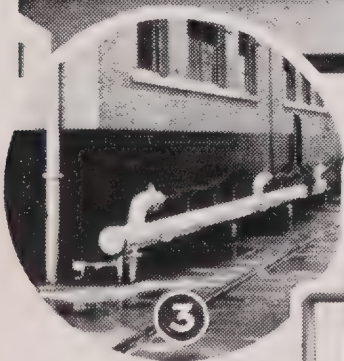
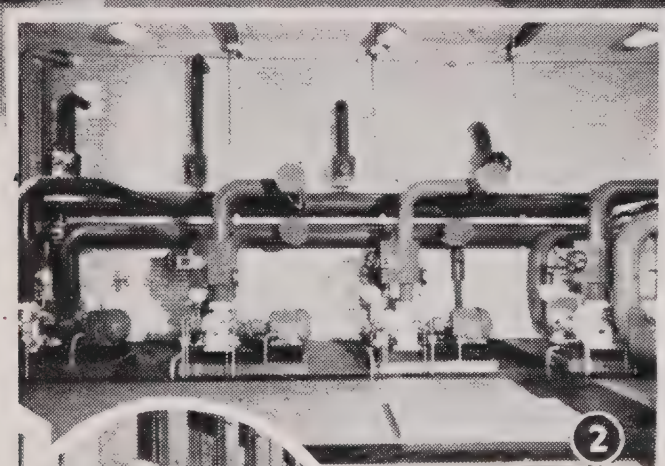
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- 1 View in firing aisle
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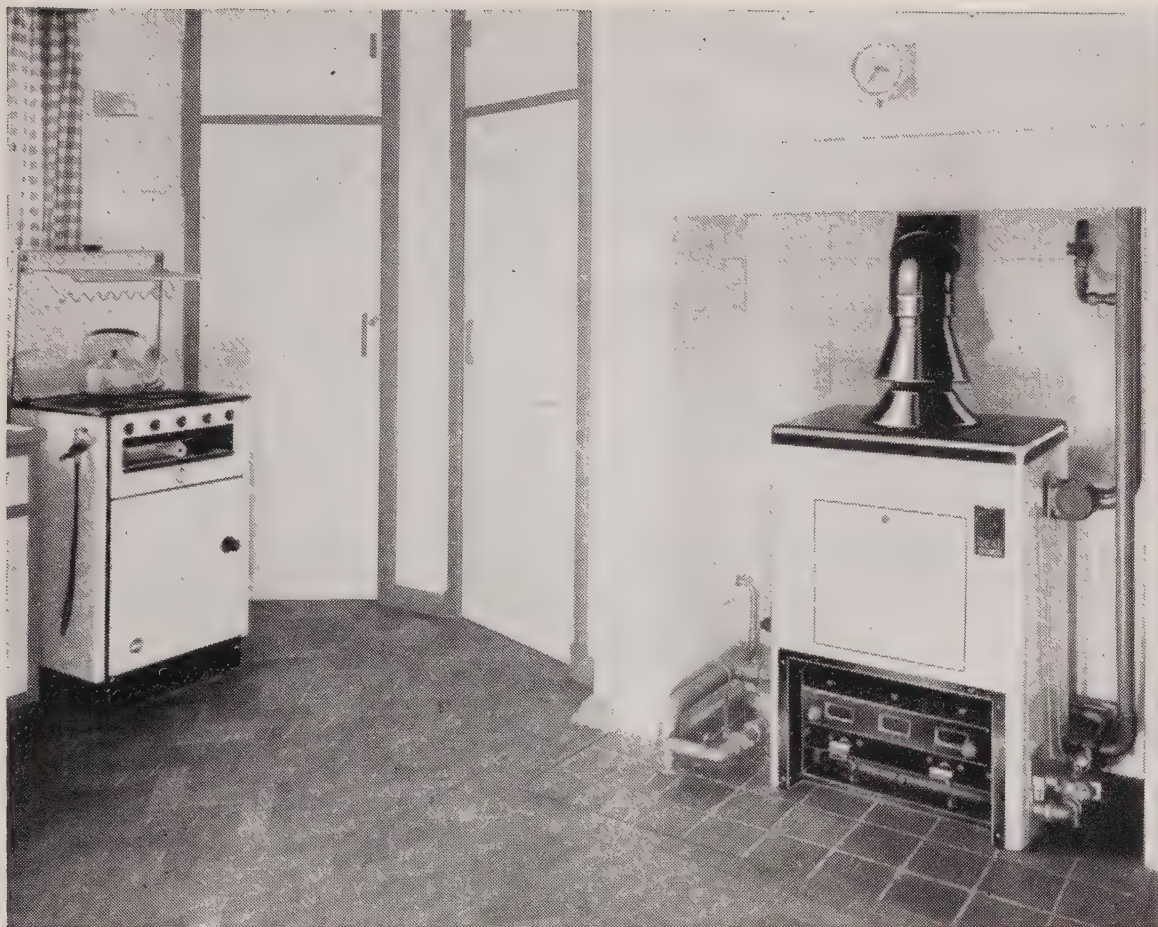
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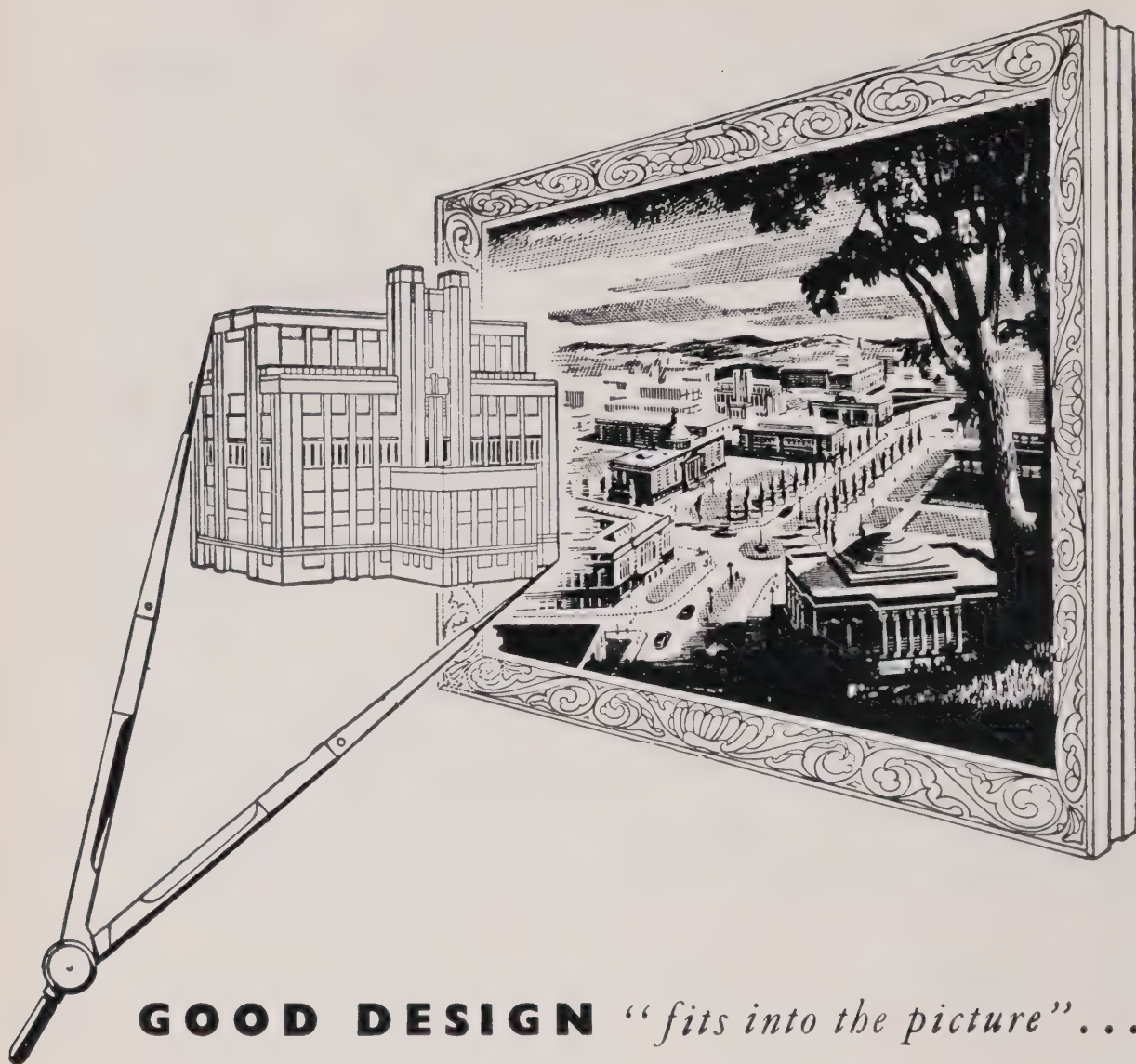
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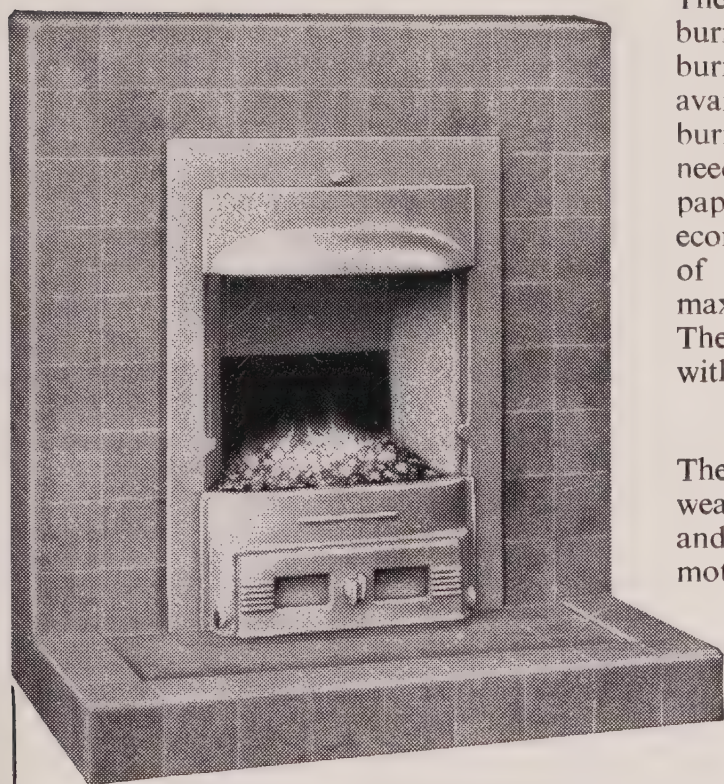
WHEN FULL ADVANTAGE is taken of the "Vector's" convection heating capabilities, it provides background heating for one or two other rooms, as well as a more even temperature in the room where the fire is installed, and it provides domestic hot water.

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The "Vector" is a continuous burning convector fire, which burns smokeless fuels. It is available with a gas ignition burner which eliminates the need for lighting fires with paper and wood. It burns coke economically from a minimum of $\frac{1}{2}$ lb. when idling to a maximum of 3 lbs. per hour. The fire burns for 10 hours without refuelling.

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The "Vector" has a hard-wearing, vitreous enamel finish and is obtainable in beige mottle, or black.



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A product of the

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SMOKELESS FUEL

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- CLOSED STOVES • DOMESTIC BOILERS

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SMOKELESS AIR

Vol. XXI. No. 78

Summer, 1951

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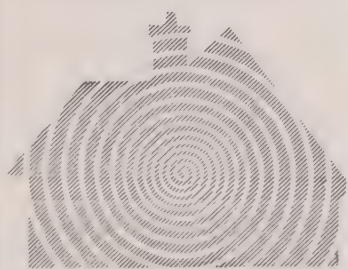
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air*

SMOKELESS AIR

Privately Built Houses

IT will be recalled that in November, 1948, the Minister of Health and Secretary of State for Scotland, following one of the Simon Report recommendations, informed local authorities that in all future housing schemes they should specify "only the types of solid fuel heater contained in the list of approved appliances circulated from time to time." The Society had been urging this step and at its Harrogate Conference in 1949 passed a resolution expressing appreciation of the Minister's action and asking for the requirement to be extended to houses built under licence by private enterprise.

This, we are pleased to report, has now been done, and on another page we quote the text of a circular on the subject that was sent to local authorities in January last. It will be noted that reference is made, in addition to houses being built, to work of conversion and adaptation.

There is as yet no control over the installation of appliances in houses where no licence is required, and the elimination of the obsolete, wasteful appliances will not be completed until this is done. It means, briefly, that as the Simon Report recommended, "the manufacture and sale of new appliances falling below approved

standards should be prohibited as soon as possible."

Smokeless Zones Again

The Women's Advisory Council for Solid Fuel has recently issued a "policy report," which is a well-presented and well-documented review of the solid fuel situation as it affects the small house, and of the views of the Council. This Society can fully agree with, and even applaud, much of the policy here expressed, even though, as is perhaps inevitable with all bodies associated with the coal trade, the continued use of raw bituminous coal in the home seems to be regarded as desirable even on a long-term, ideal basis.

Because of this fundamental and restrictive outlook it is natural that the Advisory Council—and the Coal Utilization Joint Council, as Mr. Williams made clear at the Margate Conference—should seem to accept the existing difficulties in the supply or development of production of solid smokeless fuels and should not be notably ardent in seeing these difficulties overcome. This accounts for the present report discounting the Simon Report's recommendation for a 20-year programme for the substitution of bituminous coal by solid smokeless fuel in the home, and for rejecting the establishment of smokeless zones: even presumably the few "mainly experimental" zones desired by the Simon Report.

It is declared that there should be a policy of what is called "progressive national smoke reduction" in preference to the "piecemeal establishment of smokeless zones," and that "if existing coke supplies were concentrated in smokeless zones it would mean that other areas would have to go short and there would be no overall gain in the interests of national smoke abatement."

This is quite wrong. There would be no overall reduction in the amount of smoke emitted, but its distribution would be so altered and its mean level of concentration so reduced that very considerable benefits would follow.

One reason for smokeless zones is that they are a practicable means for improving conditions in the near future in the smokier districts, and that this is made possible by their purposely piecemeal nature. The more concentrated the smoke the more cumulatively harmful are its effects, and although no one would wish to restrain the use of smokeless fuels in the smaller and cleaner towns and villages, their use should be actively encouraged or required in the more congested, smoky towns (where industrial smoke, not considered by the Advisory Council, is of course an equally important factor in determining smokeless zones).

As had been pointed out before, the planning of smokeless zones is one of the things likely to stimulate a policy for the greater production of the smokeless fuels they will require. If we are to sit back and merely hope for it, progress is likely to be much less than piecemeal.*

The Year Book

Members will have received their copies of the Society's new *Year Book*, which combines the information previously given in the Annual Report with material of more general interest. It has been well noticed in the Press, and as far as we know has been approved by members. We believe that it is something that can in future editions be made still more useful and suggestions from members for additional material will be welcomed.

Classes for Boiler Firemen

It has been emphasized by the Minister of Fuel and Power that a careless stoker can waste as much coal in a day as can be won by a miner. Our Chairman, Mr. Sydney Duguid, who is himself an organizer and lecturer in courses on boilerhouse practice, points out that now, during the summer months, is the time for those concerned (and those who should be concerned) to make preparations for next winter's classes and

* See page 158 for a few further comments on the value of smokeless zones.

to start the publicity they need to secure good numbers of students. There have been some encouraging reports of the last session and as the work is so important to smoke abatement it is hoped that even better progress will be made in 1951-52.

News from the U.S.A.

We hope in our next issue to be able to give a report of the first annual convention of the reorganized Air Pollution and Smoke Prevention Association of America, held during May in Roanoke, Virginia. It was a most successful meeting and the Association was able to announce a new mark of its progress—the enrolment of the first municipality as a member :

Allegheny County. Hundreds of municipalities are represented in the Association through individual memberships, but this is the first—what we would call—local authority member. The Association is shortly to publish the first number of a journal, for which the intriguing title *Air Repair* has been chosen.

We express our sympathies to the Association on the death, on March 21st, of Mr. Frank A. Chambers, a founder of the Association and for many years its secretary-treasurer. He joined the Chicago smoke inspection staff in 1908 and became its chief four years later. Under his direction the department grew into an organization of 56 employees.

Ministry of Health Circular on Solid Fuel Appliances in Privately Built Houses

(No. 7/51, 22nd Jan., 1951)

1. I am directed by the Minister of Health to refer to Circular 170/48 about the installation of solid fuel appliances in local authority houses, and to say that he has been considering how to ensure that private persons building under licence should not adopt less efficient standards of heating.

Issue of Building Licences

2. The installation of modern appliances in new houses is so important a part of fuel economy that the Minister thinks this is a factor which local authorities could properly and ought to take in account in considering proposals from private developers. The Minister accordingly requests that all housing authorities at the earliest stage in licensing procedure should inform applicants that they expect houses built under licence to comply with modern standards of domestic heating, and consequently that, in considering applications, they will require to know what are the developer's proposals for heating by solid fuel.

3. Appliances selected for this purpose should be at least as efficient as those required for local authority houses, and local authorities should, therefore, ensure that the types specified are among those included in the accompanying list of "Recommended Domestic Solid Fuel

Appliances," issued by the Coal Utilization Joint Council. Appliances recommended for local authority housing by the Department of Scientific and Industrial Research and by the Ministry of Fuel and Power are marked on the list with an asterisk. Appliances not so marked are more expensive types, which attain a standard of efficiency at least as high as those recommended for local authority housing.

4. Where work of conversion or adaptation includes the installation of solid fuel heating appliances, local authorities should similarly ensure that the types specified are included in the recommended list.

5. The list should be available for inspection by applicants ; if further copies are needed they may be obtained direct from the Coal Utilization Joint Council, 13 Grosvenor Gardens, London, S.W.1.

6. If a prospective developer wishes to install an appliance not on this list, the local authority, if in doubt about the suitability of the appliance, may consult the Principal Regional Officer, who will be prepared to give advice on the question.

Use of Oil-Fired Boilers

7. The arrangements under which new consumers wishing to use gas oil or fuel oil are required to obtain the permission of the Ministry of Fuel and Power have been withdrawn, and the provision of a supply of these fuels is now a matter for arrangement between the consumer and his oil supplier. Paragraph 3 of Circular 69/50 is accordingly withdrawn.



1851

A Hundred Years of Smoke Prevention



1951

SINCE 1851 is the year of honour in this present festival year, a quick look back at some episodes in the story of smoke prevention seem to be called for. 1851 itself, it may at once be admitted, has no special significance (as far as we know) for smoke prevention, but it is true to say that around the middle of the century the increasing seriousness of the smoke problem was being noted and talked about in and out of Parliament. Thirty years were to elapse before organized public action began to be taken, but in 1845, when Paxton was planning the great exhibition, a Select Committee was inquiring "into the Means and Expediency of Preventing the nuisance of SMOKE, arising from Flues or Furnaces."

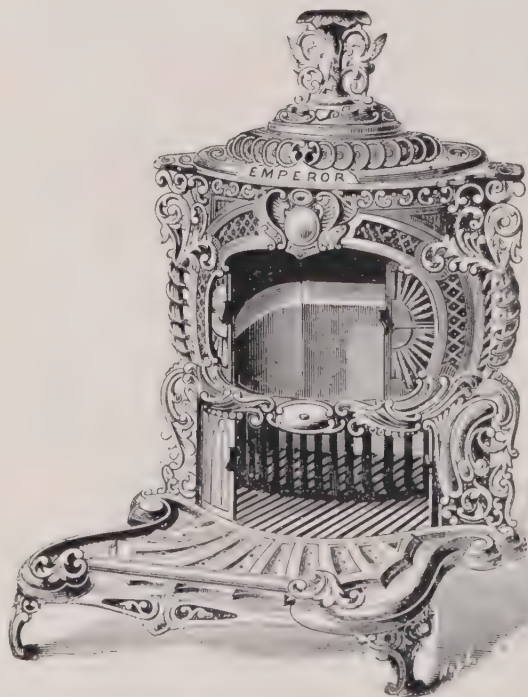
In the Society's library is a solitary volume of the Minutes of Evidence, covering two days, when the witnesses examined were mostly Ironmasters or Distillers. They were all pretty much of the same mind: it was not practicable to prevent smoke, and anyhow, it didn't matter much. Thus Mr. George Smith, distiller, of White-chapel:

"I do not consider it a nuisance; it is a question certainly of a degree of dirt, and soils everything that stands around it, no doubt; but, as regards an inconvenience, a person who has been in London all his life, as I have, makes up his mind to a certain amount of inconvenience."

This Committee recommended legislation to deal with smoke from furnaces and steam engines, although "it is not expected in the present state of knowledge that any law can be practically applied to the fireplaces of common houses." Smoke abatement

clauses were duly included in certain subsequent legislation, but with what effect it is now difficult to judge. In 1853 the General Board of Health was asked to report on inventions for the consumption of smoke, and two years later published an interesting report that gives us a picture of the extent of the smoke evil at that time, and the efforts being made to abate it. In 1845 for example, a cotton mill in Manchester emitted smoke for 8 hours 52 minutes during an observation of 9 hours.

The 1845 Select Committee referred to evidence given by the Mayor of Leeds, and to "Mr. Gott's engine," which suggest that smoke could be abated. There is also a reference



*One of the earliest slow combustion stoves,
using the same principles as today
(Courtesy of Smith and Wellstood, Ltd.)*



An impression of Sheffield, 1874

(Picture Post Library)

to the engine pumping the water for the fountains in Trafalgar Square, and its smokeless furnace working with what seems like a chain-grate stoker. More radical in its approach, however, was the proposal of Mr. William Flockton, surveyor of Sheffield, in 1849. He proposed that the chimneys of every house should be connected with a down current shaft, which in turn would connect with a flue running under the street. These flues, also in communication with the sewers, "would gradually converge to one large and lofty tower or chimney. In the lower part of the tower a fire was to be kindled, and in this way all the smoke, sewer gases, etc., drawn out of all the ramifications of this network of sewers and flues, and in their passage through the fire be consumed and rendered innocuous." The fire would, it was thought, be self-supporting, and would produce a "flame of such magnitude and brilliancy as to assist

materially in lighting the district by night."

The Fogs of 1873 and 1880

Whether it was the fact that 500 Londoners above the average died in one week of December in 1873, or whether it was the more unusual coincidence of smoke fog during the Cattle Show, leading to the deaths of many valuable beasts, may be a matter of conjecture, but the severity of that year's fogs undoubtedly did much to stir the conscience of the public about the evils of smoke. This was strongly reinforced by another outstanding fog in 1880, when in one week deaths from respiratory diseases were 1,118 above the average.

As a sequel, in 1881, the Public Health and Kyrle Societies got together and set up a joint committee which organized the first smoke abatement exhibition to be held. It was in the "Exhibition Galleries,"

South Kensington, and was attended by 116,000 people. Fuels, appliances for domestic use, and industrial furnaces and engines were shown, and the committee arranged for the testing of grates, stoves and furnaces by a panel of eminent scientists, the results of which were embodied in a subsequent "Official Report."

We unfortunately possess no details of the London exhibition, but have some interesting records of what was virtually the same exhibition in Manchester the following year. It was organized by the Manchester Noxious Vapours Abatement Association and held in the Campfield Market in Deansgate—near, if not on, the site of the present City Hall buildings where our Fuel Efficiency Exhibition was held last year. The hall was provided free of charge by Manchester Corporation and a guarantee fund against loss (which brought in £700) was contributed to by individual supporters.

Six issues of a halfpenny *Exhibition Review* were published during the six weeks run of the show, and a set of these are in the Society's library. Today they make fascinating reading, and though they contain a number of serious articles on the different aspects of the problem—including a lecture by Sir Oliver Lodge and some solemn contributions "by a Lady"—they are sprightly productions. The Exhibition seems to have been much more of an "event" for the city than in these days could be possible, and there was, for example, a *conversazione* or *soirée* of over a thousand guests and described as "brilliant."

Of the exhibitors and advertisers only two whose names are still familiar in the smoke abatement world are to be noted—Edward Bennis, of Bolton, who showed his mechanical stoker, and the Eagle Range Company, which exhibited several cooking ranges and a slow-combustion stove.

The testing of appliances was given a practical purpose as the following programme item reveals :

Monday, April 24th.—TRIAL OF COOKING STOVES from 10 a.m. The



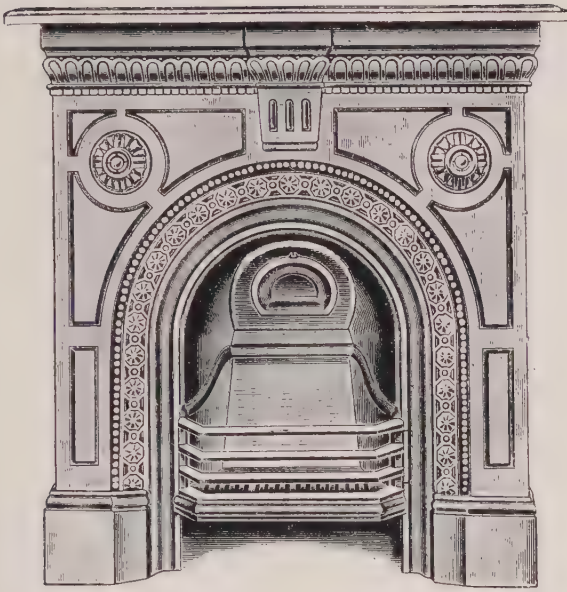
Medal awarded at the Manchester Exhibition in 1882

Stoves will simultaneously cook a number of joints of meat, vegetables, etc., with which will be entertained at 2 p.m., 100 boys from the Ardwick Green Industrial School. *The BAND of the Institution will be in attendance.* COTTAGE COOKERY LECTURE at 7 p.m.; the demonstrations will include Potato Soup, Apple Dumplings, Exeter Stew, Hashed Meats.

A contemporary review of the smoke problem says that the exhibitions did a great deal of good, and after they had closed a meeting at the Mansion House, London, in July, 1882, decided to continue the work of the joint committee by setting up a National Smoke Abatement Institution.

This body held a crowded meeting—"many London and provincial manufacturers being present"—in the Mansion House in the following year, with the Lord Mayor of London in the Chair, and a most distinguished body of supporters, including the Dukes of Westminster and Northumberland. Two resolutions were passed at the meeting, one of which called on the Government to set up a Royal Commission to inquire into the problem (a Departmental Committee was appointed thirty years later!), while the other may claim to be the first of a series that stretches down to the present day—and, quite probably, on to tomorrow! It ran thus :

"That the stated objects of the National Smoke Abatement In-



A typical Victorian open fire lacking any form of combustion control
(Courtesy of the Planet Foundry, Ltd.)

stitution, and the success which has attended its past efforts, have established a claim upon the substantial support of this meeting, the City of London, and other great cities and towns."

Alas, although one of the noble dukes started the ball rolling with a cheque for £500, the Institution did not for long survive. It had perhaps been born too soon. It did, however, publish, about 1886, a remarkably informative lecture by the Hon. Rollo Russell, which among other things included the first reasoned estimate of the monetary cost of smoke.

From then, until the Coal Smoke Abatement Society took the place of the Institution in 1899, there is nothing to report. That small but valiant organization, with Sir William Richmond, the artist, as its President, and Dr. H. A. Des Voeux as Treasurer, deserves sometime an article to itself. With an annual income of about £200 it employed its own smoke inspector, arranged tests on appliances, sponsored the first systematic measurements of pollution, and, as its records show, certainly did a great deal to clean up London. When it began not a single local authority in the metropolitan area exercised its powers

to abate smoke, and the Society became a most annoying thorn in their flesh. As one example, in 1900, when they started, they reported to the City of Westminster no less than 68 premises emitting 4,231 minutes black smoke. By 1908 they had to report only one of them for emitting 13 minutes smoke.

There was an exhibition organized by the Society in London in 1912, and in the provinces one at Sheffield in 1909 that led to the formation of the Smoke Abatement League of Great Britain. How the League and the Society came together in 1929 to form our present Society was told in our "coming of age" story last year.

The history of smoke abatement is of interest both in itself and because in many ways it is a microcosm of our country's progress during the past century in technology and social welfare. We have seen magnificent achievements, but much confusion and new problems arising in their wake. Smoke itself is a symptom of the immature technology that is still with us in so many fields. It was inevitable that it should overshadow the great glass exhibition buildings in Hyde Park in 1851, but surely it is a reflection on twentieth century man that the same sulphurous soot should be descending on the South Bank, and the marvels and achievements that it portrays, in this year of 1951?

Roofing Troubles. Lancashire's smoky atmosphere is reported to be the cause of the corrosion of the roofs of many prefabricated houses in certain areas. Ministry housing experts have concluded that the moisture and high chemical content of the air in north-west industrial areas are largely responsible. The aluminium type of house is suffering most. Bolton Town Council have asked other authorities in Lancashire to support them in a joint approach to the Ministry for help in paying for replacements.

Parliament Discusses the Smoke Problem

A Debate on the Adjournment in the House of Commons on 27th February, 1951

Mr. Anthony Greenwood (Rossendale) : Although it is only six months since this question of smoke pollution was raised by my hon. friend the Member for Small Heath (Mr. F. Longden), I make no apology for raising it again tonight. It is now 645 years since Parliament first concerned itself with the nuisance caused by smoke and it seems that the rate of progress depends on the impatience and persistence with which we urge the need for action.

What the public often fail to appreciate is that when coal is burned in such a way as to foul the air it is being used uneconomically. As the Minister of Fuel and Power has pointed out, it is no longer true to say, "Where there's muck there's money." The truth is that where there is muck there is waste ; indeed, it has been estimated that so uneconomically do we use our resources that we waste as much as 80 million tons of coal a year. I do not want to put the case as strongly as that tonight, although I do not want to minimize the importance of fuel conservation from the national point of view.

An inefficient fireman who allows his chimney to belch out black smoke can waste as much coal in one day as a skilled miner can produce. Dr. Parker, the Director of Fuel Research for the Department of Scientific and Industrial Research, has estimated that of the 190 million tons of coal we burned in 1948, 7,250,000 tons went straight into the air in the form of 2 million tons of tarry smoke, over 500,000 tons of grit and 4,750,000 tons in the form of sulphur. In other words, we blew the work of 25,000 miners straight up the chimney and the

air is fouled as far afield as the South-West Coast of Ireland and the Isle of Man where it has been said that they could tell when the wind was blowing from Lancashire because the white sheep turned grey. That waste alone is bad enough, but it is not the whole picture.

Those of us concerned with this problem of dirty air have a number of charges to add to the indictment. We believe dirt and smoke are bad for health. They ruin our buildings. They damage our agriculture. They make for drabness and depression in the industrial areas. It is not possible to calculate the total cost, but it seems improbable that it is less than £200 million a year. Let me take first the charge on grounds of health. The deposit of solid matter from the air varies from as little as 10 tons per square mile per year in the rural areas to as much as 2,000 tons per square mile per year in the worst industrial areas. I think it is probably true that between 400 and 500 tons per square mile per year is a fairly typical figure for our industrial areas, and it is there we have to look for the chief damage to health.

Sir Sylvanus Vivian, a former Registrar-General, has said that one of the reasons why the urban mortality rate is higher than that in the countryside is that the smoke from factories and houses reduces the effective sunshine. He has also pointed out that the mortality rate of children under five suffering from bronchitis and pneumonia is heaviest in Lancashire and in the West Riding of Yorkshire because of the smoke and the attendant fog and deprivation of sunshine.

Sir Alexander Macgregor, a former medical officer of health for Glasgow, has said that smoke may reduce the ultra violet radiation by anything from 50 per cent. to 80 per cent. and in the worst cases even more. It has been established that after periods of smoky fog, or "smog" as the Americans aptly call it, the death rate from respiratory diseases, for example, pneumonia and bronchitis, soars in the industrial areas. It seems that there is no direct connection between polluted air and the development of tuberculosis, but it seems fairly clear that a dirty atmosphere exacerbates the disease and may in the long run hasten death. There seems, on the other hand, a good deal of evidence for saying that there is a direct connection between smoke pollution and cancer of the lung. The smoke in the atmosphere contains various carcinogenic substances—I think that is the term—which include arsenic. Doctor Stocks, also of the Registrar-General's Department, has summed up the position in these words :

"Either smokiness of the atmosphere is an important factor in producing cancer of the lung, or sunshine is an important factor in preventing its incidence."

I think it is only fair to add that at present research is being carried out into this problem by the Medical Research Council under the direction of Sir Ernest Kennaway.

My second charge is on grounds of damage to agriculture and natural life. In East Lancashire the pollution of the atmosphere is such that land in the Rossendale Valley needs an extra five hundredweight of lime per acre per year to put it into good heart. Around the Burnley district the figure is nearer half a ton. In the same area the dirt in the atmosphere kills the clover and makes the grass poor and coarse. There are a number of reasons for that. In the first place, smoke blocks out the sunlight. Second, the deposit of dirt on the leaves blocks out the sunlight and suffocates plants because it prevents them from breathing. Third, acids in the air lower the



Mr. Anthony Greenwood, M.P.

vitality of the plants ; and last, acids in the soil make it sour and reduce its fertility.

I think the most interesting research into this aspect of the problem has been carried on in Leeds where it has been shown that lettuces sown on the outskirts grow to three times the size of those sown at the same time in the industrial area. Evergreens in the suburbs are five times as big as ones of like age in areas like Hunslet. In the centre of the city privet loses its leaves by November whereas in the suburbs it is green throughout the year. That is a terrible indictment of the smoke in cities like Leeds. To come nearer to Westminster, hon. Members will know that almost the only tree which flourishes in London is the London plane. The reason is that the plane sheds its bark every year and so avoids being suffocated by a coat of dirt. Even at Kew, a comparatively clean part of London, the dirt is so great that the National Collection of Conifers has had to be transferred to Kent.

Other effects of pollution are difficult to assess. All one knows is, to give one example, that the laundry bills in Manchester are much higher than in Harrogate. Chain stores find that their bills for decoration in industrial areas are twice those in the country. The joint stock banks spend far more on cleaning in the smoke ridden cities than in the rural areas. And, perhaps most important of all,

the work of the housewife is made infinitely more difficult and infinitely more discouraging, and her curtains and furnishing fabrics rot much more quickly.

In this very Palace of Westminster we have had a painful and expensive lesson in the dangers of smoke pollution which has caused nearly as much damage to the fabric as did Hitler's bombers during the war. Even before the war the damage was estimated by Sir Frank Baines, Director of Works in the then Office of Works, to be about £1 million. Hon. Members have only to walk across Parliament Square to see the disfiguring effects of smoke on Westminster Abbey and St. Margaret's Church. In the Chapter House of the Abbey, where Parliament used to meet 600 years ago, the 13th and 14th century paintings have been marred by the poison in the air. Another of our great London monuments, Greenwich Observatory, has been moved away, because the man-made filth made it impossible to observe the stars in their courses.

This is a terrible indictment of the effects of man-made pollution of the atmosphere. It is a terrible story, and one which I do not believe we can allow to continue. I would put to my hon. friend a number of questions which I hope he will be able to answer. I ask him to tell us what progress is being made towards getting rid of atmospheric pollution. Is he satisfied with what is being done to create smokeless zones, in which Manchester and Salford have pioneered the way?

Mr. L. M. Lever (Manchester, Ardwick): Manchester was the first to introduce them.

Mr. Greenwood: I am very happy to hear that Manchester was the first. Obviously, it was one of the cities where it was most necessary. It is as well, perhaps, that they have such public spirited civic leaders as my hon. friend.

I also want to ask whether the Parliamentary Secretary is satisfied with the production of dust extractors and other cleaning machinery for industry. Are we producing enough of the new

coal fires recommended by the Fuel Research Station, and are local authorities installing them? Is the National Coal Board pushing ahead with the establishment of low temperature carbonisation plant for the production of smokeless fuel? Are the burning spoil banks of collieries being extinguished? Is my hon. friend satisfied that we are doing enough to educate industry and the public in the importance of clean air so that the nuisance of dirty air may cease?

Drab and dreary towns are psychologically bad. Smoke and dirt are wasteful and unhealthy, and our people need something better. I hope that this debate will do something to stir the public conscience so that when our young people go walking on what Blake called our clouded hills, they will find them clouded as God intended them to be and not foully befogged by Mammon.

Commander Noble (Chelsea): I am glad that the hon. Member for Rossendale (Mr. Anthony Greenwood) has had an opportunity to raise this matter. I should like to support him in what he has said. I am afraid that I cannot give the House figures similar to the most interesting statistics that he has given relating to this problem as it affects the whole country, but as a London member I should like to emphasize what he has said about the bad effect of smoke pollution on health and, of course the very great inconvenience that it causes from many points of view. The root of the problem is that we have to make the makers of smoke as smoke conscious as are the people at the receiving end.

There is absolutely no doubt that people in London, especially those in certain areas, suffer considerably from the dust and grit contained in smoke. Those who had anything to do with convoys during the last war will remember that a ship which made smoke was a great danger not only to itself but to the other ships in a convoy. After a few ships had been sunk because of this, most ships in convoy

and those at sea in general, became smoke conscious, and the position changed. That is the outlook which we must instil into the makers of smoke.

Some of the large organizations in London have taken a lot of trouble on this question. The London Transport Executive which has a large power station at Lots Road in my constituency, has fitted a most extensive plant, over a period of months, which is now 100 per cent. complete. I have seen this plant and the amount of grit that it extracts in a week. It is remarkable to see it and to realise that, if that equipment had not been fitted, these many tons of grit would be in the air of London. The British Electricity Authority at Battersea are taking similar action.

There is no doubt that a great deal remains to be done. I wonder whether the gas works in London, for example those at Fulham and Battersea, have taken similar steps to those taken by the national organizations. I would make a plea to the Minister to make certain that all new undertakings, whether national or private, should fit some grit or dust extracting plant. There is one other point which I should like to make in this connection. I understand that in the case of electricity undertakings, it is not the undertaking that has to make the decision. It is the Ministry of Fuel and Power which decides whether a new electricity undertaking should fit what is called flue-gas washing equipment. I hope the Parliamentary Secretary will discuss this question with his right hon. Friend to make certain that there is never a case where that equipment is not fitted, especially in London.

I was not quite certain who was going to reply to the debate tonight as I was not sure, in consequence of the recent change-over, whether this subject still remained with the Ministry of Health, but I am glad to see the Parliamentary Secretary to the Ministry of Local Government and Planning here in his new capacity, and I hope

he will give us a most encouraging reply, and especially to the questions asked by the hon. Gentleman opposite, to show that he is fully conscious of the importance of this problem.

Mr. William Paling (Dewsbury) : I think that we all feel that we owe a debt of gratitude to my hon. Friend the Member for Rossendale (Mr. Anthony Greenwood) for raising this question tonight, for many of us feel that it is a most important question both to the industrial towns and the villages of this country.

It is rather significant that, in my own constituency last week, a very well-known and important individual, who used to live in the town and has a great love for it, had occasion to visit Dewsbury for a semi-civic function. In his opening remarks, he referred to the town in terms something like this : "Dear old, dirty, grimy Dewsbury." He had a genuine love for the town, but apparently, no love at all for its dirt and grime. In towns like Dewsbury, and similar towns in the West Riding, which are situated in a basin, the smoke menace is something quite appalling, and is having a very detrimental effect on health, property and everything else. No matter how hard the local authorities may work to improve their services and amenities, the smoke menace very often undoes most of the work they attempt to do.

There is one point which I would like to bring to the attention of the Parliamentary Secretary, and it concerns burning slag heaps. In addition to the smoke of industrial towns, where we also have colliery slag heaps burning away, we get not only the menace of the smoke but that of the sulphur fumes which penetrate into the homes of the people in the vicinity of the slag heaps. I should like the Minister to pay special attention to this problem. During the war some attention had to be paid to the burning slag heaps, because the fires attracted enemy aeroplanes, and so the fires had to be extinguished. We went a long way towards solving the difficulty at that time, but now we have got back to the old order of things in which the

slag heaps are again burning away and it is almost impossible to live in reasonable comfort in their vicinity, according to the direction from which the wind is blowing.

In addition to all that, we get all the difficulties with which the housewife has to contend in keeping her home clean and her family healthy, and if the Minister can give us any hope that this problem is being dealt with vigorously, in an effort to subdue the menace of smoke and sulphur fumes from chimneys and slag heaps, we shall go away feeling happy.

Mr. Keeling (Twickenham) : I support everything that has been said by the three hon. Members who have spoken, except that on one point I would join issue with the hon. Member for Rossendale (Mr. Anthony Greenwood) when he blamed smoke for the fact that the fabric of the Palace of Westminster has had to be refaced recently at a cost of many hundreds of thousands of pounds. That is not due to smoke, but to the fact that the wrong stone was chosen by Barry 100 years ago. Westminster Hall, which is 850 years old, has stood up very much better, and has not had to be refaced to any large extent, which simply shows that William II and Richard II knew a thing or two about the right sort of stone to use in London's climate, which Barry had either forgotten or never learned 100 years ago.

Mr. George Thomas (Cardiff, West) : I wish to support my hon. Friend the Member for Rossendale (Mr. Anthony Greenwood) and to suggest to the Minister that if a man leaves his wireless on and is a public nuisance, something can be done about it, whereas this smoke nuisance, which can be a far more evil public nuisance can apparently go on unrestricted. The approaches to Swansea and South Wales are a dread to motorists and public alike owing to this dreadful smoke problem there. I live in the Rhondda Valley and we used to be smoked out in the days when mining was its chief industry. In our village we now have modern factories in place

of the mines, and it is a clean, happy little township. I hope that the Minister in reply to the most felicitous speech made by my hon. Friend the Member for Rossendale will hold out some hope of abating this nuisance wherever it occurs.

The Parliamentary Secretary to the Ministry of Local Government and Planning (Mr. Lindgren) : I was almost beginning to think that hon. Gentlemen were so delighted with the speech of my hon. Friend the Member for Rossendale (Mr. Anthony Greenwood) that I was not going to get a chance to reply. My hon. Friend the Member for Rossendale has been devoting a large amount of his time and energy and skill to river pollution, and I am delighted that he has now turned his attention, and his great gifts also, to the question of the pollution of the atmosphere. As he said, it requires quite a robust constitution and a very strong pair of lungs to flourish in a polluted atmosphere. It is fairly obvious to everyone, I should think, that smoke, dirt and soot inhaled into the lungs must have a deleterious effect on the vigour of the body.

The next point on which I wish to agree most heartily with my hon. Friend the Member for Rossendale is the fact that smoke abatement is good business economy. Approaching the smoke problem from two different points of view, it is obvious that smoke abatement and fuel economy go hand in hand. I can assure my hon. Friend that our Ministry work in very close conjunction with my right hon. Friend the Minister of Fuel and Power and his Department, in all aspects of this work. I wish to do the Ministry of Fuel and Power full credit. I have here a whole series of pamphlets and booklets to which I would like to refer if only I had the time—one, for example, on the very point raised by my hon. Friend, that even where all the equipment is efficient a stoker who is doing his job badly can cause a great deal of damage. The Ministry of Fuel and Power have issued a stoker's manual and run courses for the general



Mr. G. S. Lindgren, M.P.

(Courtesy Daily Herald)

education and the better equipment of stokers for carrying out their job.

I cannot quite agree with my hon. Friend the Member for Cardiff, West (Mr. G. Thomas) when he suggests that there is now not even a legal code to deal with smoke nuisance.

Mr. G. Thomas : It is not very effective.

Mr. Lindgren : There is the Public Health Act, 1936, which embodies the provisions of previous Acts from the time of the introduction of railways in the 1840's.

I must say that, so far as the evidence I have been able to obtain is concerned, local authorities take their job very seriously. But, of course, their problems vary in degree, as do their opportunities of dealing with them. Last week-end I was in the City of Stoke. The problem there is widely different from that in the town where I live, Welwyn Garden City, and the resultant condition of the atmosphere has no direct relationship to the desire or energy of the local authority. Both authorities have, in fact, done their

job as well as circumstances permit.

One of the problems is that under the Public Health Act, 1936, unless it is black smoke that is emitted it is a defence to prove that the best practicable means have been used to eliminate the nuisance. That lets out quite a large number of instances where there could be improvement. My own Ministry is always available to local authorities when they are in difficulty with any special problem. We are freely at their disposal although, of course, we wait until we are asked before we come to their help. That help is frequently asked for where there are special difficulties with special industries, and we have often been able to assist.

My hon. Friend the Member for Rossendale referred to the question of smokeless zones. My hon. Friend the Member for Ardwick (Mr. L. M. Lever) has left the Chamber, but I cannot let Manchester get away with it. If they thought of a smokeless zone first they were not the first to put it into practice. There is only one local authority which has a smokeless zone in operation. It is the City of Coventry. The Manchester zone does not come into effect until 1952. To do Manchester credit, however, they had to have a period of delay so that industrialists within the designated area should have the opportunity to make the necessary changes in the supply of power for their factories.

There are other local authorities who have taken special powers. It is possible for local authorities to take power by a local Act. There is a model Clause available for Private Bills and my right hon. Friend hopes to see local authorities taking greater advantage of local Acts to bring this about. The model Clause is there and we are watching the Coventry experiment with great interest. We shall watch all the other experiments to see whether we can bring this into general legislation later.

Smokeless zones, of course, depend very largely upon the planning of the

(Concluded on page 151)

THE PROBLEM OF COLLIERY SPOILBANKS

A New Experimental Approach

By L. Davies, M.R.San.I., M.S.I.A.

THE Ministry of Health was rather tardy in recognising that the smell and fumes arising from burning spoilbanks could be a source of nuisance affecting the well-being of those who were unfortunate enough to live in colliery districts. It was not until August, 1939, that the Public Health (Coal Mines Refuse) Act was put on the Statute Book. This Act classifies a coal mine dump as a Statutory Nuisance under the Public Health Act, 1936, if it is liable to spontaneous combustion.

During the War the Alkali Department of the Ministry of Health was asked to work with colliery managements to control combustion on the spoilbanks, especially those which were actually on fire. The Inspectorate devised a method of treating the heaps with a finely divided spray of water. This method was eventually adopted for all spoilbanks giving off excessive glare and proved very successful. In the report of the Alkali Inspectors for 1948 the spoilbanks in England and Wales which had been inspected by the Department were classified as under :

<i>Number of Spoilbanks at end of 1948 in :</i>			
Class A (no smoke or fume)	239		
Class B (slight smoke or fume)	181		
Class C (much smoke or fume)	36		

It is recognised, however, that this solution is only a temporary one. If spraying is discontinued the heap is likely to fire again and this has actually happened. The Department recommend that if spraying is broken off a close watch should be kept on the temperature of the spoilbank so that if the critical combustion temperature is approached spraying can be re-

started immediately. Search for a permanent solution to the problem has led mining engineers to consider whether much of the pit dirt now brought up to the surface could not be conveniently stowed underground in the "goaf" or waste areas of the mine. Stowing underground has been little resorted to in this country, therefore keen interest has been aroused in the recent announcement made by the National Coal Board that it is proposed to remove a spoilbank at Donisthorpe Colliery (Leicestershire) estimated to contain 300,000 tons of material, and stow it underground by pneumatic means.

This method of stowing was pioneered in this country by Bullercroft Colliery where it was introduced in 1946 in the hope that it would reduce the number of "gob fires" which were a feature of the pit.*

In German coal mines the method has been extensively used for many years now so that in the Rhur in 1944 there were 130 pneumatic stowing plants in 52 collieries.

The system consists of blowing the pit dirt through a pipe by means of compressed air, and directing the material at the delivery end to any desired part of the "goaf" or waste area.

The stowing machine consists of a hopper into which the dirt is fed and beneath which is a cast-steel paddle wheel rotated by means of a reciprocating air-engine. The paddle wheel takes the dirt to the bottom where it is met by the compressed air-stream and blown along down the delivery pipe. The compressed air is controlled

* Earliest power stowing in Great Britain began at Lochhead Colliery in 1937, while Penallta Colliery was the first to stow material from the surface tip in 1946.—Ed.

by a valve to a pressure of 30 to 50 lb. per square inch behind the nozzle of the machine according to the length of the delivery pipe : Stowing pipes are high carbon steel pipes 6 inches in diameter, $\frac{1}{2}$ inch thick, and 9 to 10 feet long. These are provided with special joints for quick coupling. The stowing material must be pulverised in a dirt-crushing machine so that it will pass a 3 inch mesh before it is fed into the hopper. The capacity of the stowing machine is 26 cubic yards per hour. A high proportion of clayey matter in the material must be avoided as this tends to coat the pipes and increases friction considerably. A moisture content of about 12 per cent. is sufficient to prevent dust arising at the delivery end of the pipe.

The stowing pipes are introduced into the hole which is to be packed and one man controls the delivery end of the pipe directing the stowing material into any part of the pack-hole by means of a simple scoop mounted loosely on the pipe end. When the hole is full the sides are supported by steel sheets.

It is claimed for pneumatic stowing that the resultant packs set like concrete and the chances of aeration of any small amounts of carbonaceous material within the body of the pack are practically nil. The carbonaceous content of the stowing material at Bullcroft Colliery was not more than 5 per cent. and was largely composed of ripping dirt and washery dirt.

From the mining engineer's point of view pneumatic stowing results in a vast improvement in roof control and a greater safety to the miner ; it eliminates the hazard of spontaneous combustion occurring in the " goaf," and also reduces risks of surface subsidence.

To these special advantages the National Coal Board experiment will now join the large public health benefits of a far more permanent control over colliery spoilbanks than has hitherto been possible. For the Coal Board has announced that if the Donisthorpe experiment is a success it will be applied to other spoilbanks in the country.

Parliament Discusses Smoke—concluded

area. If, as one finds in Sheffield, there are domestic properties and factories mixed up higgledy-piggledy, we know, being realistic and appreciating that we have to live, it is impossible to bring those areas into smokeless zones. Where factories are sparsely spread in the area and where the industries are of a type where a change of power is a practicable proposition negotiations are undertaken with the people concerned. The question is whether or not they can change over to smokeless solid fuel, gas or electricity.

That brings me to whether industry generally is being as co-operative as it might be. The evidence I have is that it is, if not from the point of view of smoke abatement then because it has been shown to industrialists that it is a paying proposition to abate the nuisance. However, with the best will in the world, industrialists cannot get all the machinery they want for the change over. The pro-

duction of that machinery is being facilitated and industrialists are taking advantage of it whenever and wherever they can. As for London, as a good Cockney I can only say that even in my short life there has been considerable improvement in conditions and that the real smut " pea-soupers " we used to have no longer come our way.

Other measures are being taken. Reference has been made to domestic supplies. I see it is claimed by some people, particularly some industrialists, that pollution by domestic users of fuel is greater than that by industry. That seems rather to be drawing a long bow—

Commander Noble : It is true in London.

Mr. Lindgren : As far as new housing estates are concerned, there has been co-operation between my Ministry and the Ministry of Fuel and Power and a group of solid fuel appliances has been approved.

RAILWAYS WITHOUT SMOKE

Report on Railway Electrification by a Committee appointed by the Railway Executive and the London Transport Executive

SINCE its introduction in 1827 as the tractive power for public railways in this country, the steam locomotive held its position almost unchallenged for nearly a century. It is not an efficient machine thermodynamically and at times produces smoke, but in the past coal was cheap and plentiful and smoke was looked upon rather as a sign of prosperity. In some countries of Europe, however, where coal was scarce and expensive, a powerful motive existed to find an alternative source of energy and attention was directed to the production of electricity from water power.

Up to the time of the first World War, in this country, a few sections only of railways had been converted to electric traction. Parts of the suburban system of the London and South Western Railway at 660 volts., third rail, parts of the London Brighton and South Coast Railway suburban lines at 6600 volts. overhead, single phase, low frequency, and the Tyneside system of the North Eastern Railway 630 volts, D.C. third rail, may be cited as examples.

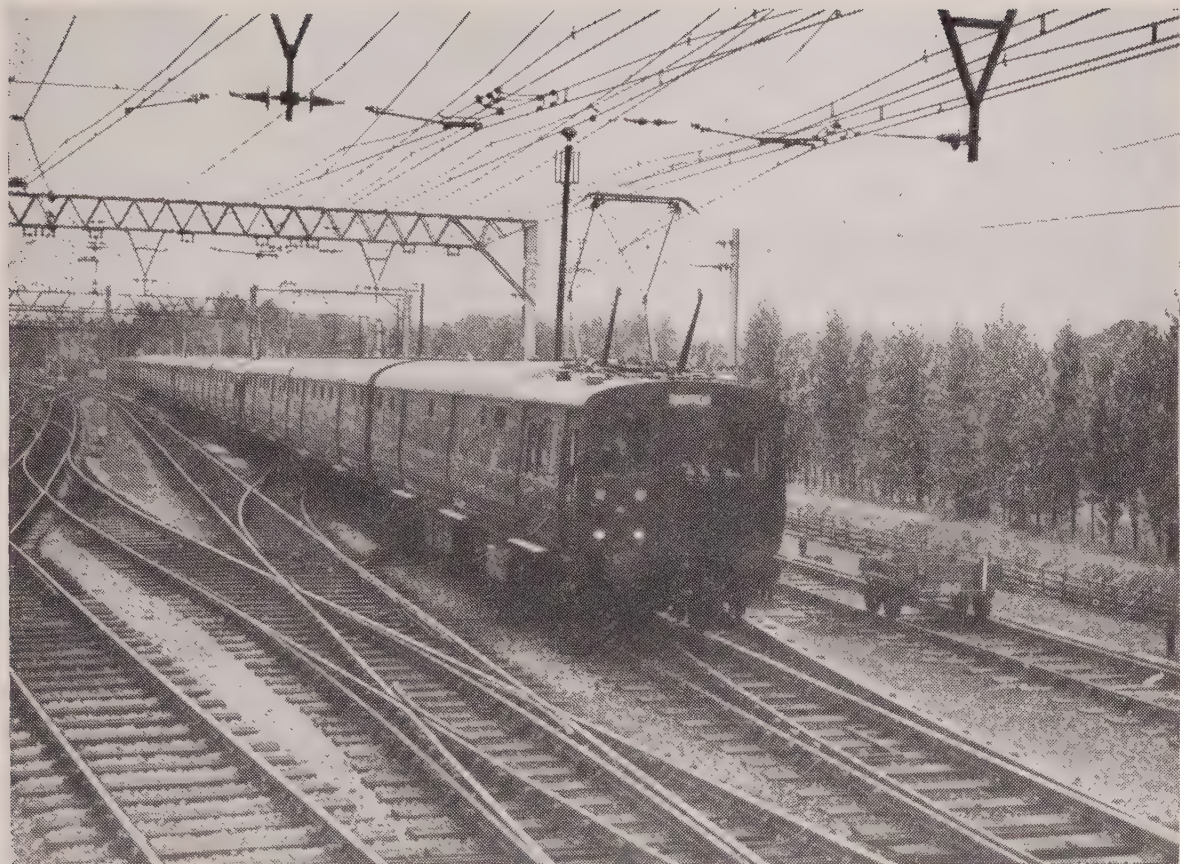
In order that railway electrification should not proceed on diverse systems, the Pringle Committee was appointed in 1927 and in its report made recommendations as to systems of generation and transmission, voltages, inter-running, standardization, and prevention of electrolysis and interference, and in 1931 the Weir Committee reported on the advisability of the electrification of the main lines. Between this and the outbreak of the second war, however, little progress was made, apart from the unification and extension of the London Transport System, and the conversion to electric traction of the whole of the suburban services, and the main lines of the Southern Railway to Portsmouth, Brighton and Eastbourne.

The recently issued report of the Committee set up by the Railway and London Transport Executives in reviewing the whole position, states that in the view of the Committee, conditions are not less favourable to electrification than they were at the time of publication of the Weir Report. The report proceeds to examine the fundamental considerations justifying the heavy capital expenditure involved, the traffic density on the lines of the Railway Executive, the various systems now available and their relative installation and operational costs under differing conditions, and makes recommendations for the establishment of a unified system, having regard to the system involved in the sections that have already been electrified.

Economic Factors

Interest and renewal charges represent a big proportion of the annual charges of an electrified railway and these charges so far as they are based on track equipment, substations, transmission lines, etc., are independent of traffic density. Economic justification must therefore be sought in reduction of working expenses or an increase in revenue or both more than sufficient to meet the additional fixed charges. Present day costs of plant and equipment, level of wages and price of coal are much higher now than in 1930, and although the increases tend to offset one another, the Committee considers that a higher traffic density is necessary now to justify electrification than that considered sufficient by the Weir Committee.

The report notes the increases in traffic that have taken place on lines that have already been electrified and considers that in respect of main line passenger traffic, express trains are likely to be lighter, faster and more frequent, suburban passenger traffic



The new Liverpool Street-Shenfield electrified line. Showing an electric train arriving at Shenfield

is likely to be heavier, and that main line freight traffic will of necessity need to be accelerated.

The characteristics of the various systems available :

1. Direct current at voltages from 600 to 3,000 with conductor rail or overhead transmission ;
 2. Alternating current single phase low-frequency at voltages from 10,000 to 20,000 with commutator or induction type motors ;
 3. Alternating current three phase ;
- are considered in detail.

It is pointed out that although with higher voltage available in the single phase alternating system, overhead equipment can be lighter, and fewer substations are necessary, in general a frequency lower than that of the electricity supply of the B.E.A. is desirable, introducing other complications, while the existing electrification on the D.C. system renders the high tension single phase system unsuitable for general use in this country,

although in certain instances its use might be justified.

The high tension three phase system has other serious disadvantages and in Italy the only extensive system thus equipped is to be converted to 3,000 volts D.C. as soon as circumstances permit.

Direct Current Systems

In considering the direct current systems the report draws attention to the merits and disadvantages of the low tension voltage of 750 and high tension of 1,500 or 3,000. Although multiple unit trains are capable of bridging the necessary gaps in the conductor rails, locomotives would not in general be able to do so. This entails the addition to the locomotive or a motor generator with a heavy fly-wheel so that stored kinetic energy is available to carry the locomotive over the gap. The overhead transmission line with underneath contact is less affected by accumulation of ice than the top contact conductor rail,

while substations now equipped with mercury arc rectifiers instead of rotary converters, can be more widely spaced with a higher voltage than when associated with a voltage of 600 or 750 volts.

The Committee recommends that :

1. General electrification should in this country in future be carried out of the 1,500 volt direct current overhead line system.
2. In the area of the Southern Region from Kent to Salisbury and Weymouth the lower voltage third rail system should be employed.
3. Dual voltage locomotives and multiple unit trains should be developed to admit of inter-running.
4. The fourth rail D.C. system should be retained on the system of the London Transport Executive.
5. The complementary use of diesel

power should be the subject of economic assessment as an alternative to the complete electrification of marshalling yards.

The illustration shows a train on the section of the Eastern Region from Liverpool Street to Shenfield converted to electric traction at 1,500 volts, Direct Current, with overhead transmission, which gives a good idea of the appearance of our railways if the electrification be carried out in accordance with the recommendations of the Committee, in contrast to view shown in the tailpiece.

It will be a long time under existing conditions before this great transformation can be carried out, and in the meantime boys of the rising generation will be able still to record the names of "Kings" and "Princess Royals." North Eastern Pacifics, and "West Countries" as they roar past, on their journeys to the North and West.



From Our Photo-Library—8

The Case for Electrification

Wm. Jackson

*Smoke Abatement and a National Fuel Policy**

THE NEED FOR FUEL EDUCATION

ONCE upon a time fuel was cheap and plentiful, and nobody but a few smoke abatement enthusiasts cared whether it was used wastefully or not. Today fuel is front page news. Its cost is a problem in both industry and home, and restrictions on its supply, in one form or another, create costs, inconveniences and discomforts that effectively prevent us from taking it for granted, like the sun and the rain, as once we did.

The problem will be with us for many years to come, and the easy days of the past have in all probability vanished for ever. Only if there is a severe industrial slump and mass unemployment are we likely to have even a temporary surplus. The mining industry is planning to increase coal output considerably, but it is going to be a costly business to do it, and it is a pity that it is necessary. It would not be necessary if the coal produced were used efficiently. The best way of dealing with a leaky bucket is not by continually filling it up.

No, logically the first thing to do is to set about ensuring that the coal already available is used to the best possible advantage. Apart from anything else, success in saving coal will lower the demand and tension that exists for more output and still more output.

The need to save fuel, to use it to the best advantage, to cut out the obvious and the less obvious wastes, and to conserve our dwindling resources of coal, has gradually come to be recognised and the answer to the

problem has come to be summed up by saying that we want a national fuel policy. The phrase "national fuel policy" has no precise meaning, and no doubt, like many other familiar phrases, means different things at different times and to different people; but broadly speaking, the policy it implies is one that ensures that our fuel and power resources are made available in the most efficient way and are utilized to the best national advantage, taking every relevant factor into account.

Fuel Efficiency

The first of these factors has made more progress than the second, and is what we usually call fuel efficiency. Its industrial aspects have been considered in another paper at this conference. They include the study of designing and using the best kind of plant and appliance for any job, and of maintaining and operating it to the best advantage. Fuel efficiency also concerns the domestic use of fuel in the same way, though here more emphasis must be placed on the design of appliances than on their operation. There have been important advances in this since the war, and we now have a list of approved appliances for solid fuels that have passed tests for efficiency. Only appliances from this list are being authorized in both local authority built houses and—more recently—in houses being built under licence from local authorities.

Since the drive for fuel efficiency was started during the war substantial savings in fuel have been achieved, and credit should be given to the excellent work of the Fuel Efficiency Branch of the Ministry of Fuel and

* A Paper by Arnold Marsh, General Secretary, read at the Inverness Conference of the Scottish Division of the Society, May 24th-25th, 1951.

Power and its staff of engineers. They would be the first to agree, however, that far more remains to be done.

The Ideal Plan

The second of the two elements in a national fuel policy is the more fundamental one of deciding what fuel is best for each type of requirement, so that the best-balanced, integrated, economical and coal-conserving pattern of production and utilization can be worked out and then—and here's the rub!—deciding how, and how far, such an ideal plan can be put into practice. This has yet to be done, and it is no easy task. Not only are there many human factors to be taken into account and allowed for—from commercial interests to what we individually prefer in our homes—but there are economic problems of no mean order. Thus, for example, while there would be substantial savings in coal in electrifying the railways much more rapidly than is now being done, such a programme depends on the availability of capital goods needed on both the railway system and for the generation of the additional power needed. Again, the abolition of the use of raw coal in the home, desired for both coal saving and smoke prevention, can only follow the erection of new carbonizing plant and all its ancillary plant, and still more electricity generating stations. Then, as we all know, electricity has run into difficulties with its peak load problem, which can only be solved by drastic restrictions on that load, or by meeting it with generating plant that, at considerable capital cost, is, in effect, needed only for the peak periods.

In short, though the saving of coal may be the fundamental purpose of a national fuel policy, it is not the only factor to be considered. In addition to the human preferences and prejudices (which cannot and ought not to be ignored), and the question of capital which have already been mentioned, there is a further important aspect that brings us to the heart of this address. That is, in framing any

fuel policy due weight must be given to the social costs of the policy, or lack of one. There are, for example, costs of transporting fuel, and the cost of collecting and disposing of ash where solid fuel of any kind is used.

The social cost—or consequence—arising from the use of fuel that stands out above all others is, of course, the pollution of the atmosphere. In material cost alone, but above all in health, in amenity, and in the waste of fuel that it represents, it is so serious a factor that it cannot conceivably be ignored in any balanced national fuel policy that may be framed. As the weekly journal *Public Opinion* recently remarked :

“But who is to determine the most efficient balance in the use of gas, electricity and coal by industrial and domestic consumer? That is a problem of the larger planning, in which the smoke abatement pioneers should have their say.”

A national fuel policy, whatever it may be, must be a matter of compromise between all kinds of conflicting possibilities. There must be a balance as between, for example, the use of raw coal, carbonized fuel, gas, electricity, and oil. There must be a balance between the capital expenditure on carbonizing plant and electricity generating plant, between the claims of coal for the home market and for export—and so on. Whatever the balance may turn out to be it is essential that the needs for smoke abatement be correctly assessed and placed on the scales. To make sure that this is done may well be one of the main duties of the N.S.A.S. in the future.

But apart from the social consequences and costs of smoke, there is also the question of fuel efficiency itself. Even though fuel is being used for the time being in ways that are not the most suitable, it is still important to get the best out of it. Thus, though we are convinced that the use of raw coal in domestic fires should be ended, it is necessary to see that while it is still being so used, it is burned as efficiently as possible.

The Moral Question

It was recently suggested that smoke abatement is above all things a moral question, and that as such it should be pursued without reference to fuel efficiency, an economic question. A word about this view, even though it may not be widely held, seems necessary. Smoke abatement has been fought for for generations on grounds that may be called "moral," if in that we include the questions of health, welfare, and amenity, but although that approach could and did assist in abating some of the worst evils of smoke, it never was, nor could be, strong enough to make a deep enough breach in the powerful walls of the accepted economic structure of our society to bring about the abolition of smoke. This is an historic fact that has to be accepted. In the further progress we demand we are bound to use every economic fact and movement, and indeed anything else, that will be helpful. For instance, the only thing that at present prevents us from talking loudly about the sulphur shortage and the fact that all the sulphur we need is going into the atmosphere as the most injurious constituent of smoke, is that unfortunately no practicable way of doing anything about it has so far been found.

In fuel efficiency, however, smoke abatement has the most powerful ally it has ever had, and which more than anything else has helped to make possible the progress of recent years. Instead of spurning it as a purely economic matter it is up to the smoke abatement movement to use it even more effectively. Incidentally, it would be interesting, but perhaps too much of a digression, to consider fuel efficiency itself as a moral question. In a world where so many human beings are prevented from enjoying in abundance even the necessities of a full life, and where the spectres of hunger and cold still haunt mankind, is not all waste immoral?

Smoke is Inefficiency

Smoke abatement, as Mr. Noel Baker, Minister of Fuel and Power,

has truly said, goes hand in hand with fuel efficiency. Smoke is the visible sign of faulty, wasteful combustion. The extra three million tons of coal for which the Prime Minister appealed a few months ago, and which in a magnificent response was produced by the industry, is practically the same as the weight of coal that will be wasted as smoke during the present year. And more: even this is perhaps only a third of the amount that will be wasted as the unburned fuel gases that invariably accompany smoke.

These statements are based, not on wishful guesswork of the smoke abatement enthusiasts, but in the careful estimates of the Fuel Research Station. Their work has shown (Technical Paper No. 55 in particular) that the greater the amount of smoke being produced the greater is the amount of invisible fuel gases also going up the chimney, unburnt, into the atmosphere. If we take this loss into account, as we should, then the total loss of coal as smoke and accompanying it, is somewhere between 5 and 10 million tons of coal a year.

Thus we see that smoke abatement enters intimately into the two factors that make up a national fuel policy—it is the major social costs that must be taken into account in determining the ideal pattern of fuel usage, and it is a consequence and the visible symptom of the inefficient use of coal.

It is not intended even to try to sketch what a national fuel policy might be, for there are many factors to be considered that are beyond those of smoke abatement to which we must limit ourselves. The controversial question of the unrestricted use of electricity for space heating, for example, does not directly concern smoke abatement, except that in balancing the *pros* and *cons* an important factor in the case for electricity is its absolute smokelessness in use.

What we can do, and what it is the aim of this paper to stress, is first to re-state some of the smoke abatement needs that in our view must be taken

into account in the framing of a national fuel policy, and secondly, to indicate some of the ways in which the smoke abatement movement, and the N.S.A.S. in particular, can help in achieving the aims of fuel efficiency and a national fuel policy as means towards its own ends.

The policy for smoke prevention that has developed during recent years is, almost entirely, equally a policy for fuel efficiency. The "almost entirely" qualification does not mean anything that contradicts fuel efficiency but merely that in some things smoke prevention goes beyond it—as for example in the prevention of grit, dust and chemical fumes.

Thus the principle of the prior approval of new industrial fuel-burning installations, whether it is included in special smoke abatement legislation or as a factor to be taken into account by planning authorities in giving their consent to developments is nothing more or less than a logical means for making sure that fuel efficiency is considered from the start. There may be argument about exactly how it should be done, or who should do it, but there can hardly be doubts about the principle—indeed, even if smoke abatement did not matter, prior approval would still be desirable for fuel efficiency.

Again, take the question of smokeless zones. If we accept the proposition that smoke indicates a waste of fuel and that it should be abated by encouraging industrial installations that will burn coal smokelessly, and by domestic methods that do not need raw coal, then we see smokeless zones simply as convenient, controllable, and adaptable devices for making steady but definite progress towards that goal. They give form and shape, and early benefits where they are most needed, to a transition that would otherwise be slow and haphazard. That is why, it may be surmised, the Simon Committee recommended the encouragement of experimental zones. Given encouragement and material assistance, and given a more general effort to attain other recommendations

of the Simon Report, smokeless zones can do much to aid a national fuel policy, and, reciprocally, a policy of the kind needed can hardly fail to facilitate the creation and gradual expansion of smokeless zones. In like manner that policy should be so framed that both the social costs of smoke and the fuel losses it entails are in every way taken fully into account.

Fuel Education

If we look at the nation's fuel problem as a whole it is not difficult to appreciate how formidable are the tasks to be faced; physical, technical, administrative, and that of securing an understanding by the public of both the situation and an acceptance of the demands it must make upon us. A great and sustained drive for explanation and education is needed. So far, this has been mainly concerned with the technical questions of fuel efficiency and economy, which can be appreciated without great difficulty, but the more complex and abstract aspects of a full national fuel policy will be far more difficult to put across.

What seems to be needed, above all else, even without such a policy to explain, is a drive for what can perhaps be summed up as Fuel Education. Its purpose would be to inculcate in its true perspective an all-round understanding of the fuel problem, and the creation of a public appreciation and sense of responsibility towards fuel as one of the basic things in our national well-being. In the schools especially, but also among the adult population, there is almost unlimited scope for a bold imaginative campaign towards these ends. "Fuel efficiency," as we have known it so far, essential though it is, is not enough.

Such work is of course, already being done in a limited way by many agencies, most of which however, are tied to one particular fuel, and which from their nature cannot present a balanced, disinterested picture. The Women's organizations for the various fuels, though they are doing excellent

work in their respective spheres cannot take the comprehensive and independent view. Other bodies, such as the D.S.I.R. and the Institute of Fuel, are disinterested but their functions do not include that of popular education. All interested organizations, however, should participate, in their own special fields, but only a Government body, or one created by the Government, could direct and co-ordinate the whole effort.

There would indeed be many strands in such a work as Fuel Education, and I wish to conclude by suggesting that smoke abatement should be one of them, and not one of the least important. Its importance lies in stressing one aspect of the problem that would not otherwise be emphasized and might indeed be overlooked: an aspect that would kindle the imagination of many, and help, because of its own special appeal, to ensure an understanding and acceptance of the measures that are needed.

The Oldest Agency

Given the support it needs smoke prevention can be a most powerful ally in the work that has been suggested as vitally necessary. Moreover, the smoke abatement movement has a right to take part, if only for the fact that as far as Fuel Education is concerned it is the oldest agency that exists. For example, it initiated the training of boilerhouse fireman, it organized the first tests on solid fuel and other domestic appliances and it was a pioneer in demanding that coal must be treated with greater deference.

One strong appeal that smoke abatement alone can make in Fuel Education is in a sense that same "moral" aspect mentioned earlier. Not only is the movement independent of sectional or commercial interests, but it brings to the mainly rather dull economic problems of fuel the more positive and intimate questions of pleasanter and healthier urban living. Already there are people who on coming into a smoky town will at once think impatiently not only of the dirt

and the lost sunlight but also of the fuel waste involved. When everyone thinks likewise, and to attain that end is the Society's purpose, we shall be well on the way not only to smokeless air but also to a national fuel policy.

To sum up: for three main reasons smoke abatement is concerned with and linked to the question of a national fuel policy. These are: because air pollution is the most serious of all the social costs of fuel usage; because smoke abatement can both assist and be assisted by fuel efficiency; and because it can play a special and useful part, not open to any other body, in the much needed and wider task of Fuel Education.

That the Society is not already doing this, except in a lilliputian way, is of course simply due to the fact that its financial resources are barely enough even to keep it going. It is anxious to go ahead on a much bigger scale, and surely therefore its campaign deserves support?

CHEMICAL INDUSTRY IN SCOTLAND

Effect of New Act

Provisions affecting the chemical industry are contained in the Alkali, etc. Works Regulations (Scotland) Act, which came into force on May 1st.

The Act empowers the Secretary of State for Scotland to make Orders extending or amending the list of chemical works and noxious gases brought under control by the Alkali Act of 1906, which provides for the registration and inspection of works likely to give off offensive fumes. Before any Order is made under the new Act, the Secretary of State must hold an enquiry and must consult the local authorities and industrial interests concerned.

The Act also enables the Secretary of State to authorize the inspection of any unregistered work that he regards as likely to cause the evolution of any noxious and offensive gas.



The 1951 Conference

To be held in Blackpool

BY kind invitation of His Worship the Mayor and the Corporation, the Society's 1951 conference will be held in Blackpool on Wednesday, Thursday and Friday, September 26th to 28th. All members, representatives and friends are cordially invited to attend what promises to be a meeting of exceptional interest.

The second Des Voeux Memorial Lecture will be, as was the first, an event to be particularly noted. The lecturer will be Dr. J. Bronowski and his subject "The Smoke Problem in its Social Setting." Those who have heard Dr. Bronowski broadcast or lecture, or have read his books and articles, will know that this is a theme after his own heart and one that he will be able to illuminate in a searching and, we are quite confident, memorable way.

The Des Voeux Lecture will be given on the Wednesday afternoon. In the morning, opening the proceedings,

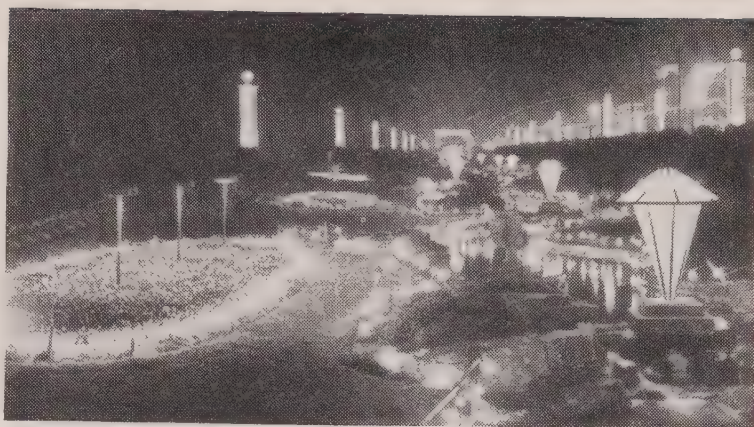
will be the Annual General Meeting and the second or retiring Presidential Address. Those who heard Dame Vera Laughton Mathew's first address at Margate last year will look forward pleasurably to this and will regret that the constitution requires the President to retire after two successive years.

On the Thursday there will be only one conference session: a morning symposium of five or six short papers on the subject of "Smoke Prevention in Small Steam Raising Plant." This is one of the basic pollution problems that have to be considered and unlike others it is one that affects every local authority in the land. Mr. W. A. Damon, Chief Inspector of Alkali, etc. Works, will preside, and the programme of papers is being arranged with the kind co-operation of the Combustion Engineering Association.

The Friday morning session will be of rather unusual interest. Sir Ernest Smith will preside and the theme will

be "Policies for Preventing Air Pollution." The speakers will represent five important industries which have not been entirely free from causing pollution in one form or another. What we have asked for is an outline of what can be done by modern techniques and planning and the new policies being developed to prevent such troubles in the future. The industries contributing are Cement, Coal (with respect to the collieries), Iron and Steel, Electricity and Gas.

The concluding session on the Friday afternoon will be on domestic smoke prevention. It will literally be "from the woman's point of view" and women speakers will give papers on the contributions of gas, electricity and solid smokeless fuels. Papers that are complementary in character, rather than competitive, have been asked for,



Blackpool by Night

but a lively discussion may nevertheless be anticipated.

To be included among the "work" of the conference rather than as relaxation are tours to be made on the Thursday afternoon to the Blackpool Gas Works and the Ribble Generating Station near Preston. Members will have to choose one or the other, but if required arrangements will be made for second visits on the morning of Saturday the 29th.

The lighter side of the programme will be a reception by His Worship the Mayor on the Wednesday evening and a social evening or "party" arranged by the Society at the headquarters hotel on the Thursday evening (tickets probably 5/- each). The famous illuminations will be in full swing and for those who seek even further relaxation there is of course all the first-class entertainment and all the fun of the fair that Blackpool has to offer.

Although there is plenty of good accommodation in the town it must be remembered that the holiday season will not be over and that early booking will be advisable. Headquarters hotel will be the Savoy, but as usual the Society cannot assist in the making of reservations.

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The “Rexco” Process

FOR 30 years fuel technologists have pointed out that the burning of raw coal is a crime, for not only are some of its valuable constituents wasted, but the atmosphere is polluted with smoke and grit.

The Coal Commission of 1925, presided over by the present Lord Samuel, presented a voluminous report on the Coal Industry and among other matters considered the question of treating coal by low temperature methods ; and arrived at the common-sense conclusion that if the products were more valuable than the raw coal plus the cost of treatment, the wealth of the country would be increased, and it should be carried on.

During the great world depression of twenty years ago, the Coal Industry of Great Britain was one of the greatest sufferers. Output which in 1923 was 276,000,000 tons per annum sank to 227,000,000 tons in 1938, and even then there was so large a surplus owing to the decline in industrial consumption and the greatly reduced export trade, that Acts of Parliament were passed to restrict output and end the severe competition between collieries, resulting in low prices and very low wages to the mine workers.

Some bankers and eminent persons, none of whom were directly interested in the Coal Industry, were impressed by the success of German progress in dealing scientifically with coal and other carbonaceous materials. Millions were spent in Germany to erect plants to work on low temperature methods ; so extensive that the bombing concentrated on these plants during the late war was not successful in completely destroying them. From these plants, treating lignite and brown coal, Germany produced millions of tons of petrol and diesel oil, and valuable derivatives through their vast chemical industry.

The problem of carbonizing hard coal under low temperature is a highly technical and difficult one, and many attempts were made in this country between 1925 and 1935, but all failed to achieve satisfactory results. The only successful company started experimental work far earlier in 1903 and for many years has produced the well-known fuel “Coalite” which is now a household word, and that company has rendered great service to the country by building and operating the only plant distilling low temperature tar oil.

When there was considerable surplus of coal, slacks and fines were put on the dumps, being practically unsaleable, and most of the efforts to invent low temperature processes were with a view of utilizing this very cheap material. But industrial science does not stand still, and busy brains turned to the invention of appliances to burn this cheap grade coal, with the consequence that in a very short time the dumps were cleared and the price consequently rose so that it is now very little below the price of large coal.

Every industrial organization should have a definite target and that of the National Carbonizing Ltd., was to produce a high grade smokeless fuel to supplement, and if possible exceed, anthracite in efficiency, so a nut size coal of high quality was used to produce a hard, dense smokeless fuel with a high degree of reactivity ; and this was put on the market in 1938 under the trade name of “Rexco.” It was decided to test the demand by letting the fuel find its own level and one leading coal merchant only was supplied to introduce it to their customers. No advertising was done, but so much was it appreciated by users that within two years about 150 coal merchants were supplying “Rexco,” and it may be observed that the retailers do not

take a new article into stock unless there is a demand for it.

The Process

The process is remarkable for its extreme simplicity. The large retorts, taking a charge of 34 tons of coal, are filled from the top through screens to eliminate fines and dust. The charge is then lighted at the top inside the retort and the gas produced is drawn through the charge and circulated through for nine hours by powerful exhausters; carbonization therefore being carried out by the gas in the coal itself.

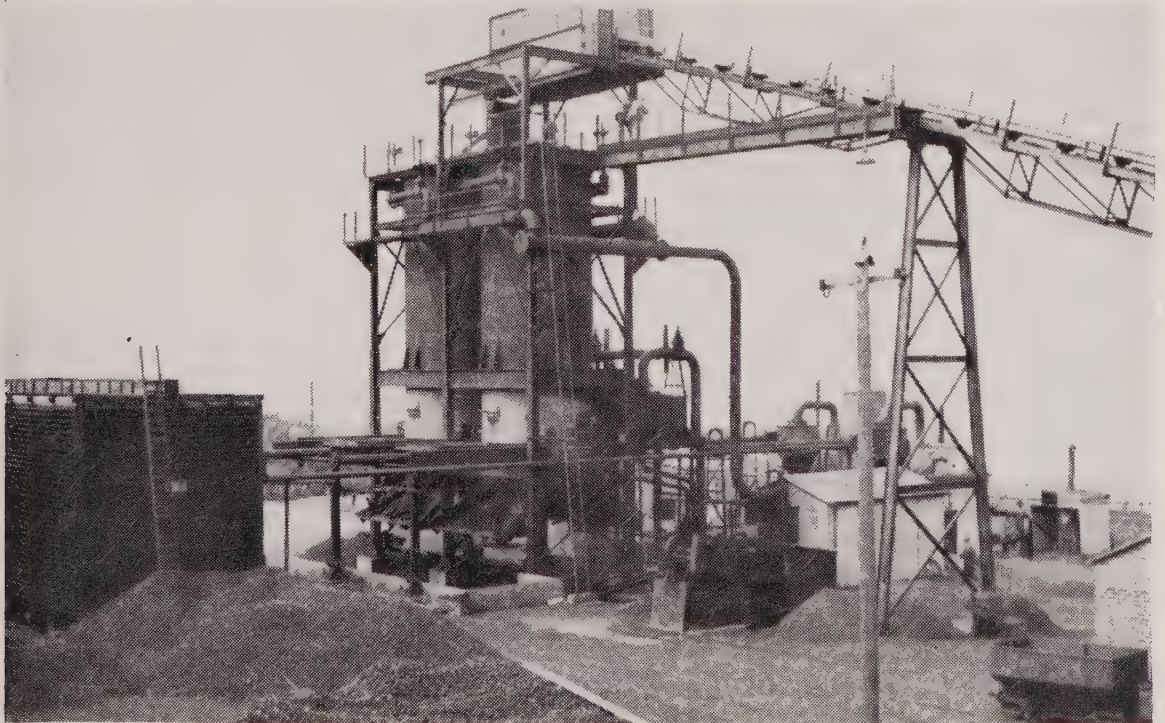
The charge is then quenched by circulating cold gas for a further period and is discharged by the grate (shown white in the photograph) being withdrawn by an hydraulic ram; and the charge now being Rexco falls on to the coke benches and conveyors for screening and grading and for direct transport to railway wagons.

The surplus gas passes through a water-spray in the wash-boxes separating the tar oils, which flow to the separating tanks.

The retorts are the largest in the world used for carbonizing and this mass production is one of the leading features. Further the plant can be shut down on Sundays and for holidays without damage.

The Rexco process was particularly designed to preserve the original capillary structure of the coal, the product resisting absorption of moisture and giving a dense hard fuel which does not break down easily, and thus avoids the accumulation of fine dust in the cellar, which is mainly waste to the householder.

It is obvious that after treating coal for some hours at a temperature of over 500° C. all moisture must be eliminated and as Rexco is loaded into coal wagons directly on discharge from the retorts, the fuel is moisture free when despatched from the Works. About 3 per cent. of moisture is picked up from the atmosphere and the product may be exposed to rain, either in transit or in coal merchants' yards; but owing to the capillary structure of the fuel it will not absorb



General view of the "Rexco" two-retort plant. Recently the discharge and transport by conveyor has been mechanized. The removable grates show light below the retorts

more than 5 per cent.

Householders who complain of clinker in using solid fuels should note that this is molten ash caused by running at a fierce heat. Rexco is so re-active that the minimum of draught is required and should be regulated to avoid the formation of clinker.

It should be appreciated that lighting an open coal fire is practising a form of low-temperature carbonization. The heat of the wood kindling first drives off the unflammable gas which passes up the chimney in the form of smoke. Is it not better that this process should be done on a large scale, and the product delivered to the consumer retaining the principal elements for producing heat? Tests by the Fuel Research Board show that Rexco gives intense heat for double as long as the low-temperature fuel taken as a standard, and tests by technologists state that Rexco gives 29 per cent. more radiant heat than the coal from which it is made. As up to 9 per cent. of inflammable gas is left in the fuel, it ignites readily, and has extraordinarily long lasting qualities. During the war tests made by a Ministry showed that 7 lb. of Rexco would keep alight for 22 hours. This flexibility makes it an ideal fuel for slow combustion stoves of all kinds; its great reactivity gives intense heat in a very few minutes when draught is admitted to a dying fire.

Two of the leading manufacturers of heat-storage cookers recommend the use of Rexco in preference to anthracite, not only for these reasons but, being always produced from the same coal-seam, the quality does not vary.

Dr. Parker, Director of the Fuel Research Board, in his exhaustive address to The Royal Society of Arts (a brief summary of which appears in the Spring, 1951, Number of *Smokeless Air*) pointed out that the main cause of smoke is the domestic open fire. Industrial furnaces can be fitted with appliances to consume smoke, but this is not possible with the domestic fire except at great expense.

The extension of the process is not only in the interest of the domestic user, but of the nation. From each 100 tons of coal 72 tons of Rexco are produced giving practically the same amount of heat as 100 tons of coal burnt raw, but in addition 20 gals. of valuable tar-oil and a surplus of 30 therms of gas are derived from every ton of coal.

The retail price is almost entirely beyond the control of the makers. Ninety per cent. of the cost of production is the cost of coal, wages regulated by the National Coal Board, and nationalized electric power. The remaining 10 per cent has to cover rent, rates, taxes, insurance and all administrative charges. The selling price at the plant is controlled by the Ministry of Fuel; the retail prices are based on this, plus railway freight and the standard margin allowed for the coal-merchant for storage, handling, and delivery costs.

Rexco is coal with all its good qualities retained and its disabilities removed and a better description of the product is Smokeless Coal. The extension of its production and use will not only further the main objects of the National Smoke Abatement Society, but will increase the wealth of the nation. The great export demand cannot be dealt with while the home market is so largely unsatisfied.

The Minister of Fuel and Power

The Minister of Fuel and Power, Mr. Philip Noel-Baker, recently referred to the difficulties in fuel supplies with which we had been faced this winter. To help us through, he said, we had imported a million tons of coal from the U.S.A., but in 1950 two million tons of coal had gone up our chimneys in the form of soot and smoke. "All of it is waste," he continued, "nearly all of it is preventable waste: preventable with the knowledge we have and could easily apply today."

SMOKELESS HOMES



Watson House Exhibition

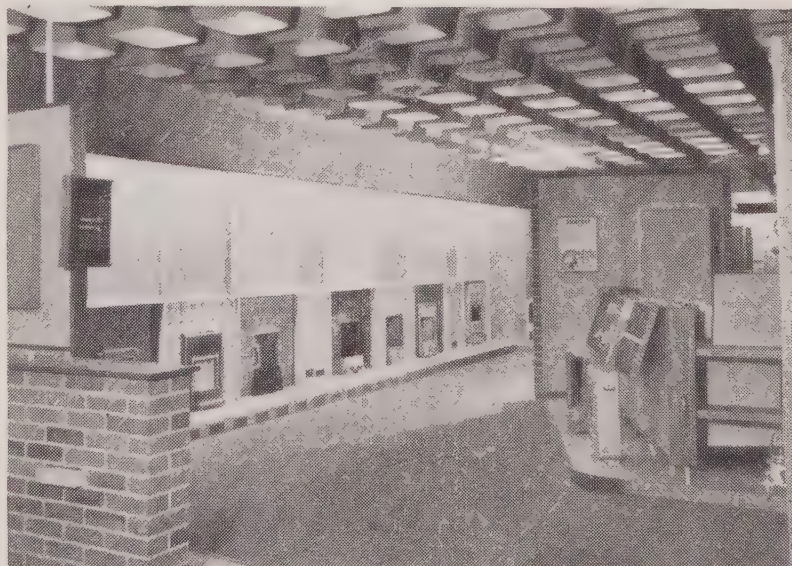
READERS may recall the article on Watson House, the gas research centre at Fulham, which was described a few months ago in these columns. A former permanent exhibition, which was damaged during the war, has now been completely redesigned and was officially opened on March 8th by Professor James M. Mackintosh, Professor of Public Health in the University of London.

If first to compel attention, and then to explain clearly and convincingly what has to be explained, are the criteria for measuring the success of an exhibition, then that at Watson House is one of the most successful we have seen. It was designed by Mr. Misha Black and the architect was Mr. Brian Peake, A.R.I.B.A. A slight impression of their excellent—and intriguing—work is shown by the accompanying photographs. The striking and colourful presentation is interesting in itself apart from its purpose—which it accomplishes admirably—of telling the story of gas and coke. The water heating section, for example, is all the more impressive for its clever and practical design. (It can be seen on the left-hand side of

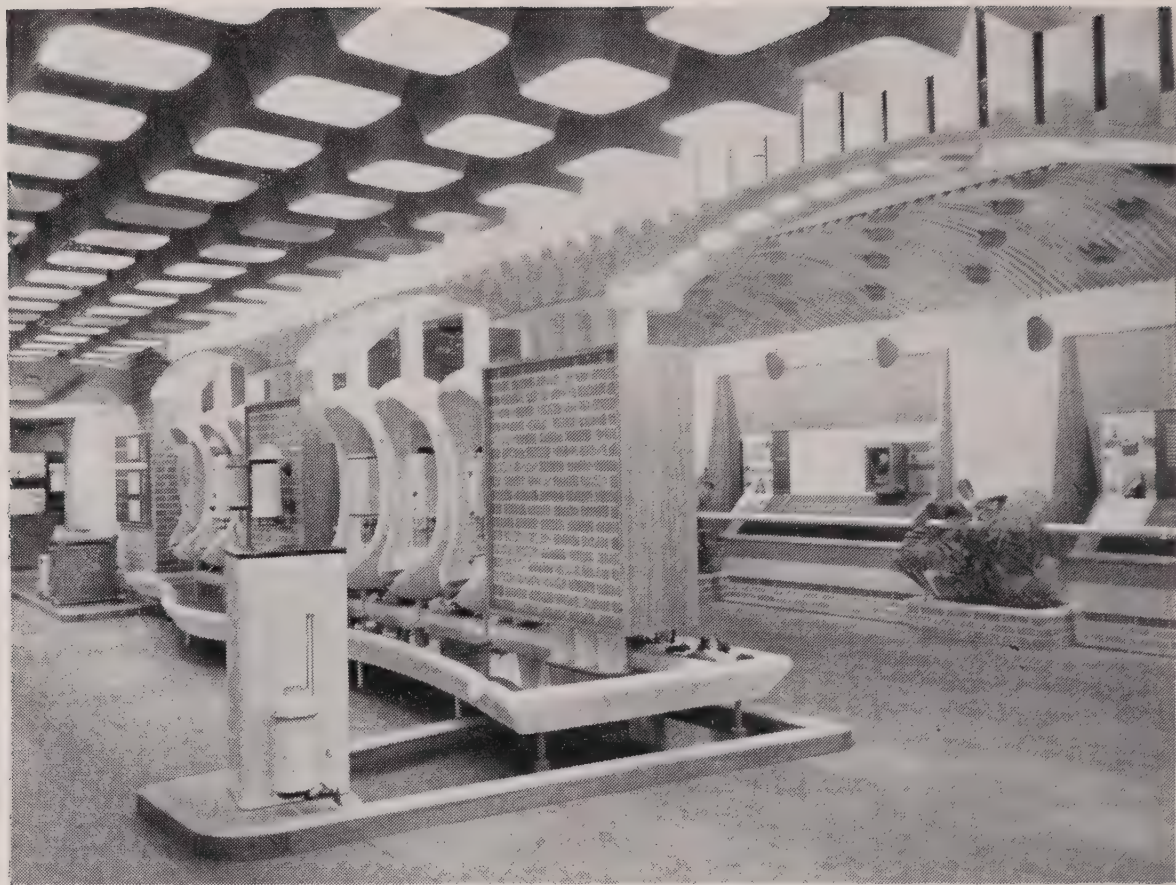
the photograph on the next page).

The visitor is given a clear explanation of, for instance, the manufacture and distribution of gas; how meters work and are fitted (a transparent meter shows all the hidden works); domestic gas and coke appliances; industrial and commercial uses of the two fuels; ventilation and flues, controls, and so on.

For those who want it, there is a considerable amount of solid technical information to be gathered from a tour of the exhibition, although many will wish to absorb only the more popular high-lights. One detail of interest that was most effective was an array of gas cookers dating from 1900 to the present day. The evolution of design was striking, but even more so were cards on each cooker showing how



Coke burning appliances at the Watson House Exhibition



A view of the permanent Gas Exhibition at Watson House

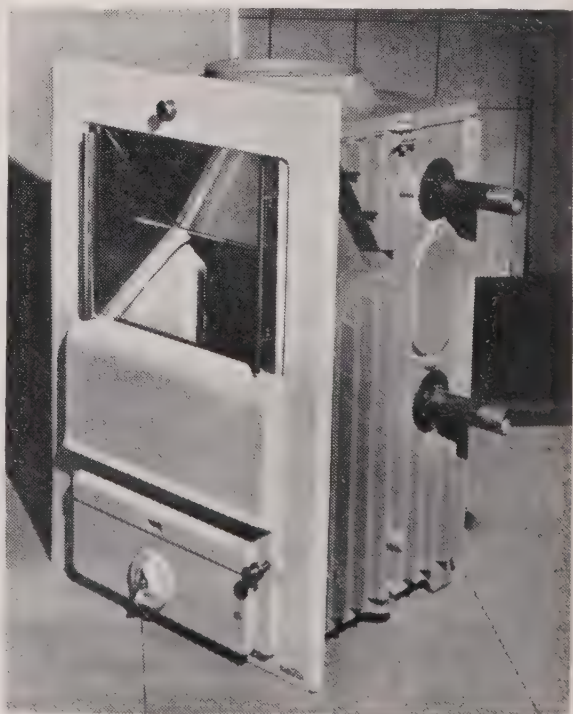
their efficiencies had improved. Thus the 1900 cooker needed 5.4 lbs. of coal for an hour's gas supply ; by 1930 the amount had been brought down to 4.5 lbs., and by 1951 only 3.8 lbs. were needed.

The Society's Executive Council met in London in May, and by the courtesy of the North Thames Gas Board a visit of its members to Watson House was arranged during the afternoon.

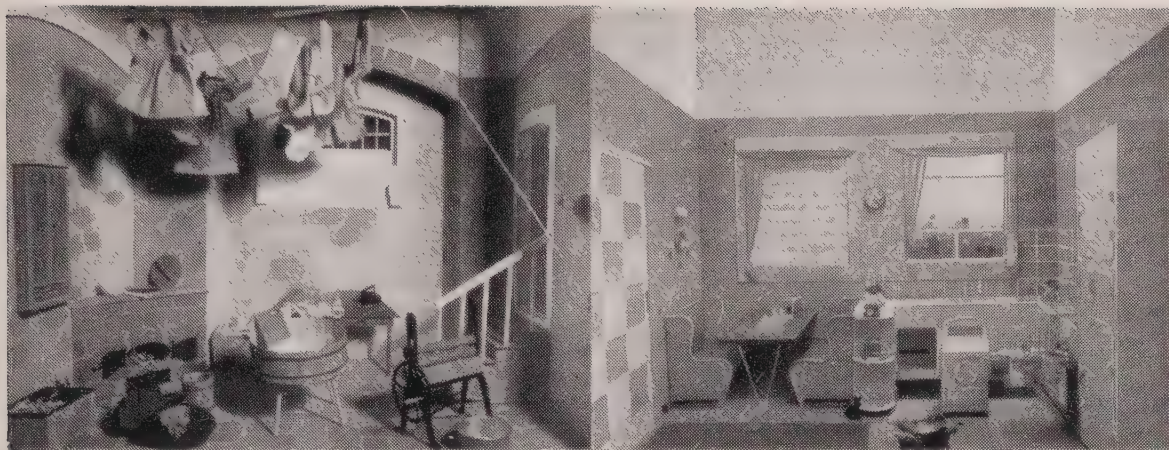
The Raymax Fire

One of the coke-burning appliances on view at the Watson House Exhibition was the Raymax fire, a model of which is shown in the illustration. It is a self-contained open convector fire, continuous burning, which incorporates a large boiler sufficient for domestic hot water, plus some radiator service. As will be seen it is fitted with a polished aluminium reflector above the firebox to radiate and reflect the heat. The appliance works on the down-draught principle and

is thus smoke-consuming even when bituminous coal is used. It is a product of Radiation Ltd., from whom



The Raymax Fire



Models from the E.A.W. Exhibition

further details may be obtained.

Electricity in the Home

An exhibition entitled "A Century of Progress in the Home" was opened by the President of the Electrical Association of Women, the Dowager Lady Swaythling, at the Association's headquarters at 35 Grosvenor Place, S.W.1, on May 1st. The exhibition

consists of a series of contrasting models of the different rooms of the house in 1851 and in 1951, and above we show models illustrating wash-day. The models, especially the more elaborate 1951 halves, were excellently contrived: so well in fact that one felt somewhat guilty in thinking that the Victorian drawing-room looked rather cosier and more inviting than its very modern equivalent. . . .

Reports from the Divisions

ALL the Divisional Councils have meetings to record or meetings about to take place, each of which deserves much more space than can be allotted to it.

The **West Midlands** Division held its first fully constituted meeting in Birmingham on April 12th. There was a good attendance at the morning business meeting, at which an informal talk was given by Mr. S. N. Duguid, who was making his first appearance with one of the Divisions as the new chairman of the National Executive Council.

After lunch members and representatives, augmented by wives and friends, embussed for Bournville, where a tour was made of the works of Messrs. Cadbury. This is a visit that will be remembered by everyone who has had the privilege of being shown over that vast, spacious factory

by one of the capable and charming ladies who constitute—so specialized is the job—a special corps of guides.

Being an N.S.A.S. visit an inspection was duly made to the boilerhouse, where power for the whole of the factory is produced from six Babcock and Wilcox water tube boilers. They are fitted with chain grate stokers, with Lea Coal Meters for each boiler. Ash is automatically handled by a Bennis Water Trough Draglink conveyor, of which two are installed. The factory steam load is such that a large quantity of low pressure steam is required for process work. Consequently it has been found possible to install back pressure engines wherein the high pressure steam is made to generate power and the pass out steam is taken round the factory for heating and process work.

Only a fraction of all that was

going on could be seen during the course of the three-mile tour. It was all most engrossing, from seeing at long last how the cream gets inside the chocolate to discovering how marvellous is the flavour of a barely-cold sampled morsel. Above all one was impressed by the space, the brightness (what tons of paint!), and the cheerfulness of the factory.

A visit on April 19th by the **East Midlands Division** was equally interesting but in a different way—in the relative tastiness of samples, for instance. It was to the Bolsover “Coalite” plant, near Chesterfield. As this was described in a recent article a further description would be redundant. There was an attendance of about 70 members, who during the visit were given an explanatory talk by Mr. A. C. Hazel of Coalite and Chemical Products Ltd.

The **Yorkshire Division** met at Harrogate on May 4th and in addition to business matters were given a talk by Mr. E. Dodsworth, Chief Sanitary Inspector of Harrogate, on the local atmospheric pollution problem. Subsequently a visit was made to Harrogate Observatory and Meteorological Station.

On May 24th and 25th the two-day annual conference of the **Scottish Division** was held at Inverness. One of the papers is reprinted elsewhere in this issue, and we hope to publish others, or excerpts from them, in the next number. On the first day there was a comprehensive survey of “The Development of Modern Solid Fuel Burning Appliances,” by Mr. A. L. Dallas, Scottish Regional Officer of the Coal Utilization Joint Council; an address by Mr. A. D. Trask, of British Railways on “The Preliminary Training of Locomotive Firemen”; and one by Mr. Gordon of the Scottish Regional Office of the Ministry of Fuel and Power on “Smoke Abatement in Relation to Fuel Efficiency.” On the Friday morning, Mr. Ashford, Senior Smoke Inspector, Glasgow, spoke on “The Responsibilities and Opportunities of

Local Authorities in Industrial Smoke Abatement”—which we should like to see studied by all local authority members and officers—and finally Mr. Marsh spoke on “Smoke Abatement and a National Fuel Policy.”

The Thursday evening produced an event, not on the programme, that was a high spot in the conference: a coach run (for which thanks are due to Inverness Town Council) to Loch Fannich to see one of the new hydro-electric schemes. It was a forty-mile journey through some of Scotland's finest scenery, and the inspection of the generating station, with one 12 megawatt turbo-alternator in operation and a second being installed, was uniquely interesting. The Loch Fannich scheme is of particular interest as it is one of the very few throughout the world that draw their water from a hole blown into the bottom of the lake—“operation bath plug,” as it was called.

The annual meeting of the **North-West Division** was also held on May 25th, and was attended by about fifty members and delegates.

An interesting discussion took place on “Local Consultative Committees” (see article in our Spring, 1951, issue, page 101), in which contributions were made by representatives from the three committees so far formed, all of which are in the North-West area. Councillor Longton, Vice-Chairman of the Divisional Council, spoke on behalf of the Widnes Committee, Councillor Heap for the Burnley and District Committee, and Dr. G. O'Brien for the St. Helens Committee. A very full and frank discussion followed and it was apparent that the meeting had been impressed by the reports they had heard. By common consent it appeared to be agreed that persuasion and education in the industrial field yield the best results, with particular stress on the economic advantages, although in a small minority of cases it might be necessary to resort to prosecution.

The **North-East Division** is to hold its annual meeting in Newcastle on

Friday, July 6th. One of the features it is hoped to arrange is an instructional trip on the Tyne.

The Tees-side Committee of the North-East Division held a meeting at Redcar on April 18th, during which, after a considerable amount of business a talk on Atmospheric Pollution was given by Mr. S. H. Richards, M.Sc., who is in charge of atmospheric research at the Fuel Research Station.

The National Coal Board's Annual Report

THE annual report of the N.C.B. for 1950 has been published as we go to press. It contains a forward-looking and encouraging section on "Making Coal Go Further," and a paragraph on smoke abatement that we were very pleased to note. It reads :

"The recommendations of the Simon Report dealt not only with the most efficient use of coal, but with

reducing pollution of the atmosphere, and the Board are playing their part in this field also. As suppliers of smokeless fuels they will send as much as they can of these fuels to 'smokeless zones.' Much of the Board's research effort is directed towards producing a greater range of smokeless fuels for all consumers."

Summing up, the report says :

"The Board believe that the country's problems of fuel supply can only be solved satisfactorily if alongside the struggle to produce more coal there is a campaign for using the coal more efficiently. The Board's policies and their research effort are directed to achieving this."

It is stated that the Board has started to replace inefficient domestic appliances in houses and offices owned by them. At Ferryhill, Durham Division, for instance, 50 modern kitchen ranges have been installed in place of old-fashioned appliances in miners' houses.



"Smog" over Capetown. Note chimneys emerging from the screen of mist and smoke.

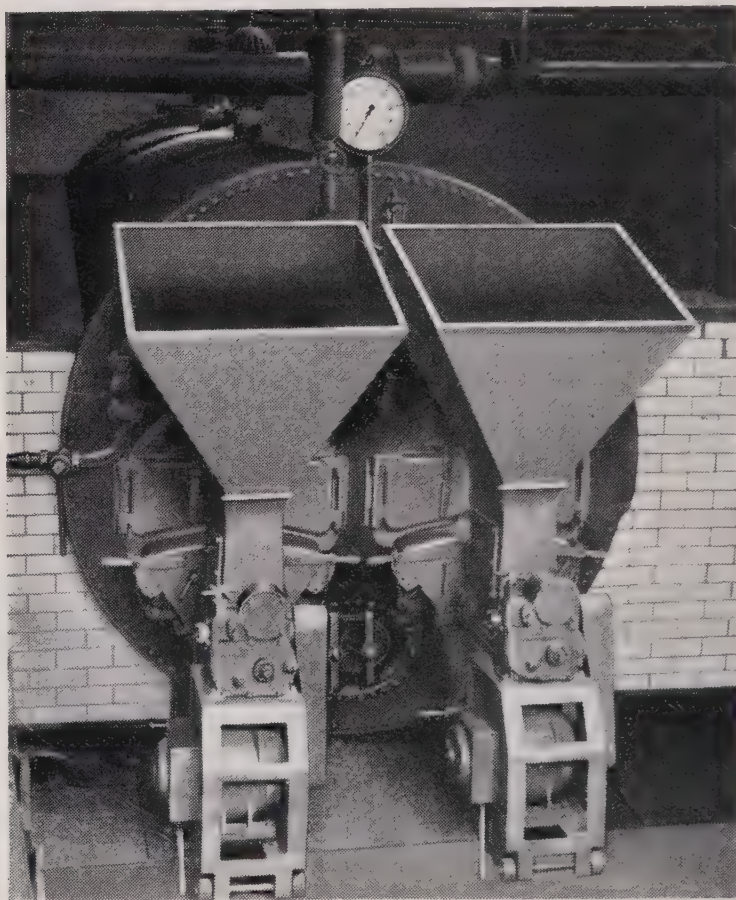
Photo by courtesy of Cape Argus, Capetown

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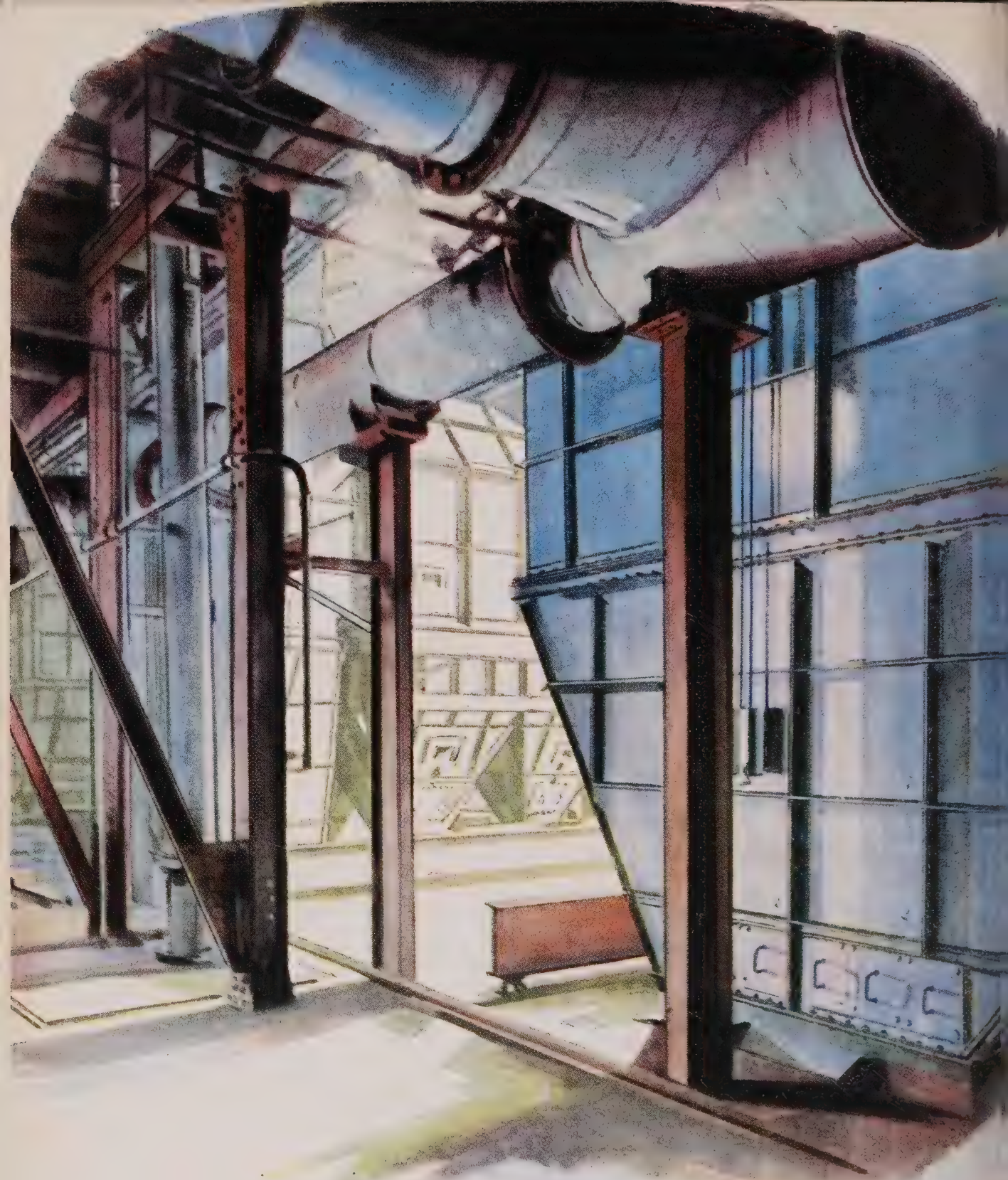
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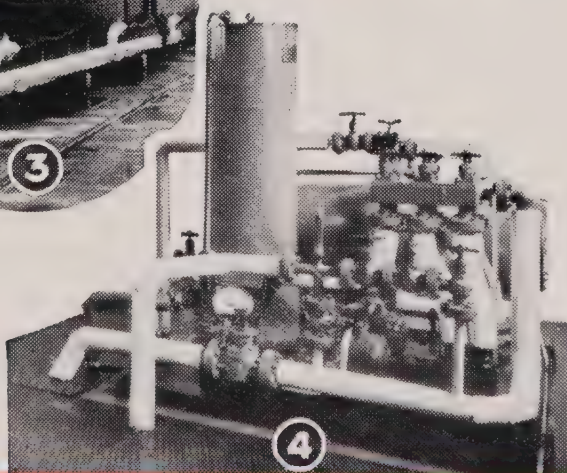
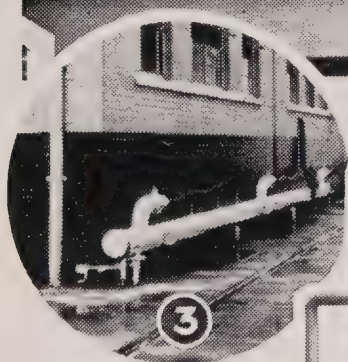
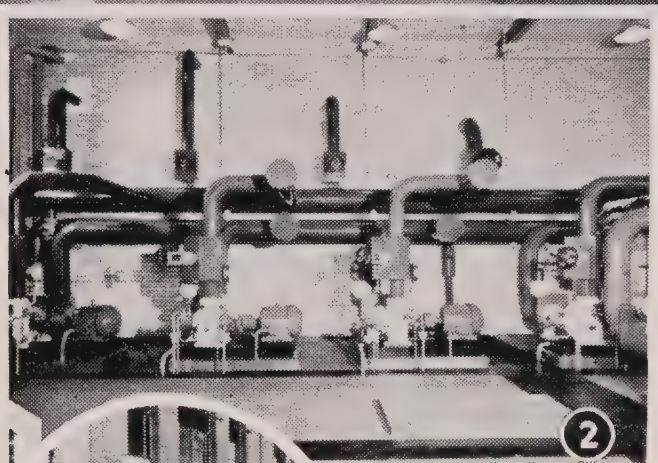
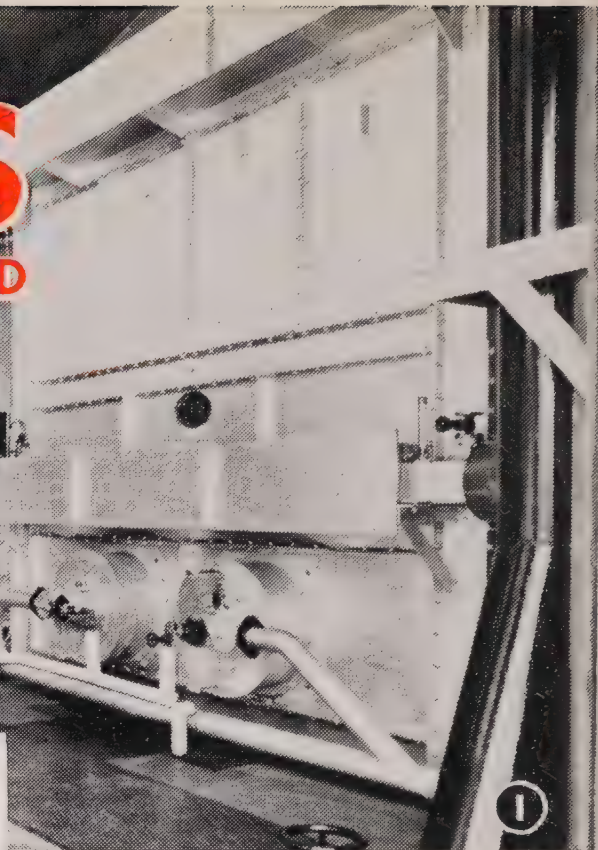
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In this Issue

Stoke Orchard
Smoke, Dust and Efficiency
The Responsibilities of Local Authorities
Education and Fuel Efficiency
The Natural Smokeless Fuels of South Wales
Un-Productivity

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- 1 View in firing aisle
- 2 Water circulation pumps
- 3 Exterior view of boiler house showing fuel oil flexible connections to railway tank wagons
- 4 Oil fuel pumping and heating unit

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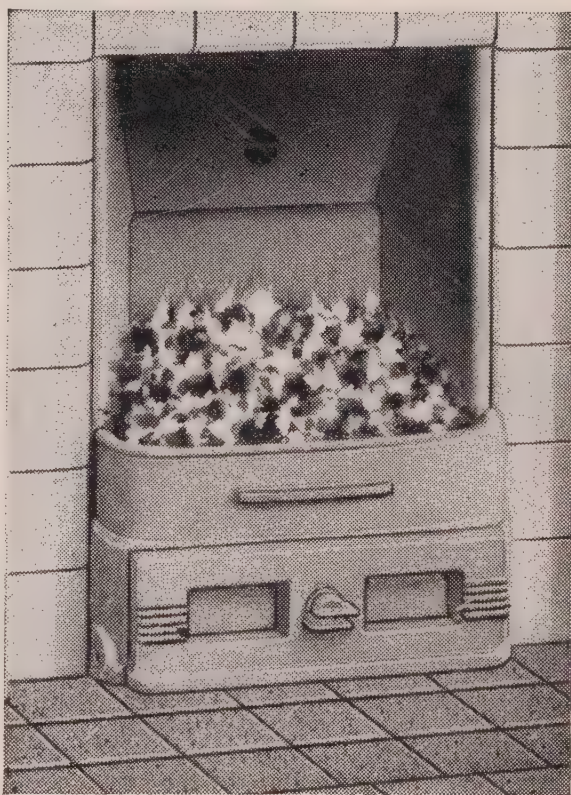
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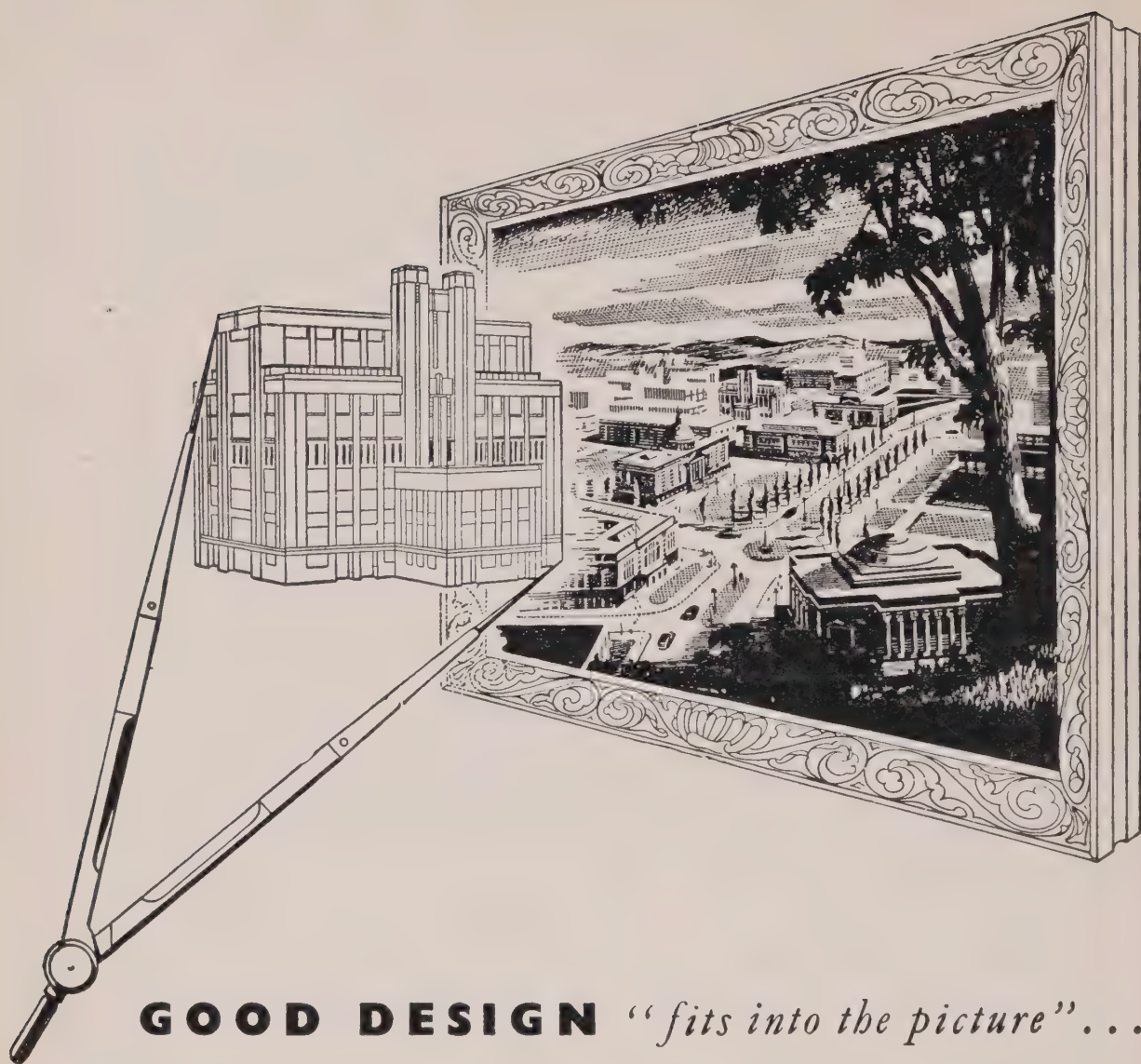
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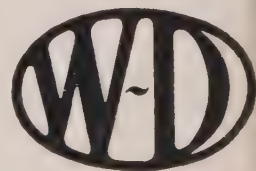
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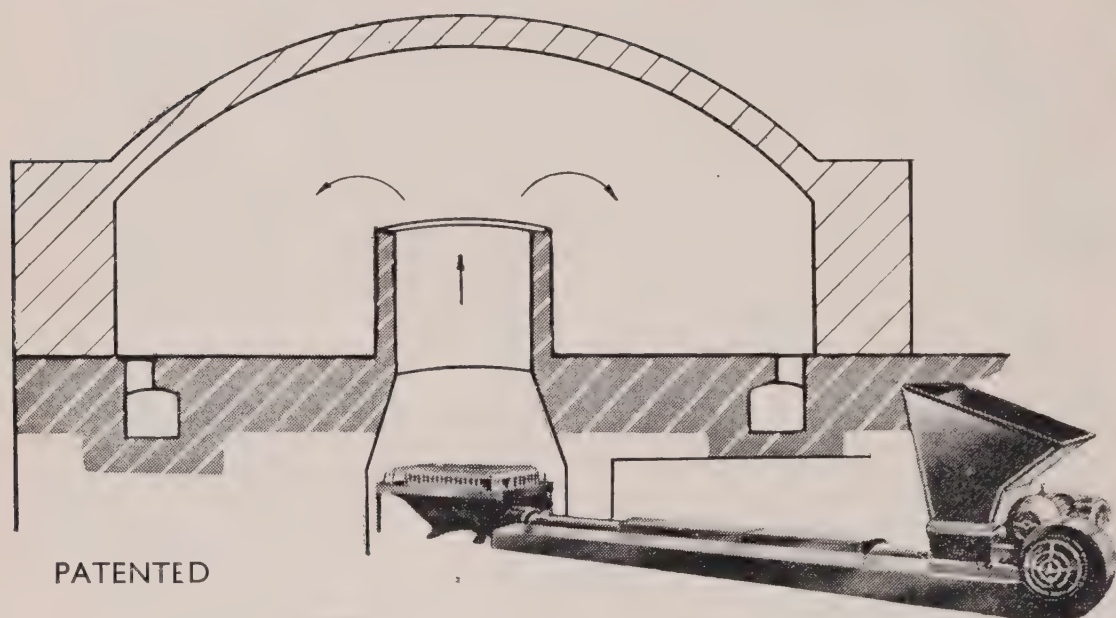
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Vol. XXII. No. 79

Autumn, 1951

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YORKSHIRE : James Goodfellow, M.R.San.I., Health Dept., 12 Market Buildings, Vicar Lane, Leeds, 1 (30211, Ex. 11).

EAST MIDLANDS : Alfred Wade, M.B.E., F.R.San.I., Health Dept., 50 Shakespeare St., Nottingham (40584).

WEST MIDLANDS : G. W. Farquharson M.S.I.A., Health Dept., 67 Broad Street, Birmingham (Cen. 7000, Ex. 442).



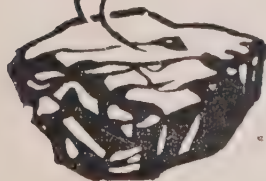
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air*

SMOKELESS AIR

Surfeit of Sulphur

REFERENCES have been made in this journal and elsewhere to the unfortunate fact that while we are bemoaning a serious shortage of sulphur there is far more than we need going up our chimneys into the atmosphere and causing more harm than its worth. Now, in a letter to *Metal Industry* (May 4th, 1951), Dr. Ulick R. Evans, of the Department of Metallurgy, Cambridge University, takes the case even further, and in a way that strengthens the need for the prevention of air pollution. Briefly, this is that the shortages of many metals from which we are also

suffering is accentuated by the fact that they have to be used in quantities greater than would be necessary in a clean atmosphere for the purpose of protecting iron, steel and other surfaces from the damaging effects of the sulphur compounds in the air.

With respect to nickel, for instance, Dr. Evans says : " There is little doubt that whereas a thin and relatively porous coating of nickel might suffice to protect sulphur-free steel from a sulphur-free atmosphere, a much thicker coat, involving far more expenditure of nickel, is needed under conditions which exist in our country. Thus the seriousness of the shortage of nickel is closely bound up

with the surfeit of sulphur. The recent 50 per cent. cut in nickel anodes, intended as an economy measure, may have unintended results. If, despite all vigilance, it causes skimpily plated goods to be put on the market, they will quickly develop rust and pass to the scrap heap, representing a complete waste of manufacturing effort, of good steel in the basis and of such nickel as may be present on the surface."

Again: "The same sort of considerations apply to protection by paints. In the present state of knowledge, we have no really reliable substitute for zinc or lead; both metals are generally used as compounds, although in some paints zinc or lead is used in metallic form. Any proposal to prohibit or seriously cut down the use of these metals in paint coats would be a policy of penny wise pound foolish."

Salford's Smokeless Zones

Particular interest will be attached to the first public inquiry, by the Ministry of Local Government and Planning, into a smokeless zones scheme. This will be held in October, in Salford, where the scheme for the establishment in the city of three smokeless zones—which will include several thousand houses—has occasioned a number of objections. We wish Salford well in its pioneer efforts to set up smokeless zones in residential areas and hope to include a report on the inquiry in our next issue. It will be recalled that a report on Salford's scheme was read by Alderman Goulden at the Margate Conference in 1950, and is included in the *Proceedings*. Latest news, unfortunately, is that Salford Housing Committee have turned down the proposal to contribute towards the cost of fitting means for gas ignition to new open grates in the houses concerned.

Trade Union Service

We congratulate a Trade Union on an excellent piece of work on behalf of a cleaner atmosphere, and only wish it was a British union concerned. It is, however, the United Steelworkers

of America (CIO) which has printed "as a public service" a most useful annotated bibliography on *Biological Aspects of Air Pollution* compiled by officers of the Division of Industrial Hygiene of the Federal Public Health Service. It contains over 300 references, with excellent annotations, and we are glad to have the volume in our library. The items are classified, with numerous cross-references, and there are many British entries, including a number from SMOKELESS AIR and other publications of the Society.

For this Relief

A sigh of relief went up in the Society's offices when it was seen that the financial year would end on June 30th without, for the first time in three years, having to dip into the diminishing reserve funds. True, the balance on the year's working will be seen to be a very small one and was achieved only because of a few new subscriptions and continuing restrictions on expenditure, and despite the sharp rises in the cost of stationery, printing, and many other items.

No Clean City

We like the comment and story about ourselves told in the *Halifax Daily Courier and Guardian*: "A glance over the articles and illustrations in the summer issue of the Smoke Abatement Journal reminds one of the two lumbermen in the Canadian wilds when one of them, throwing a book across the log cabin, exclaimed, 'It's no good. Every recipe starts, "Take a clean dish," and we haven't one.'"

Our Frontispiece

SMOKELESS AIR is not, however, exclusively a matter of dirty dishes. There is always the photograph that heads the first editorial page, and we are glad to know that many members appreciate these—no doubt for the same reason that we enjoy searching for them and deciding which to use: because of the contrast with the rest of the contents. Readers, planning holidays, even telephone to ask us

for more information about the scene of some of the photographs.

In browsing round for a new subject for this issue the sight of a photograph of yachts on a sunlit sea made us remember how keen a yachtswoman is our President, Dame Vera Laughton Mathews, and that this number would be the last to be published during her two-year term as President. So search for a subject ended, and the superb *Times* photograph we reproduce may be regarded as a slight but sincere tribute from SMOKELESS AIR to a most gracious President. It is perhaps not too much of a flight of fancy to say that such a scene suggests air not only smokeless, but at its freshest and sweetest, and that it symbolises the ideal that is at the very heart of the smoke abatement movement.

Reprimand—

No one is likely to object to such a smokeless photograph, but we have recently been chided by a local authority (a seaside town) for allowing the publication of one of our photographs that depicts (rather effectively) household smoke in a scene that has now been identified as in the town concerned. The photograph has been used on many occasions (including the dust-jacket of a book that has presumably had a poor sale in the town) and was in fact a prize winner in the competition run by the Society before the last war. Two comments may be made: if such a protest is accepted and then carried to its logical conclusion we could nevermore publish any photograph of any smoky scene. And how significant of a changing attitude to smoke that a local authority should so sensitively regard domestic smoke as bad for business.

—And Compliment

“Healthy air and uninterrupted light are among the first of the amenities of life, and we support the aims of the National Smoke Abatement Society—incidentally one of the best-run organizations we know.”—August 1951, issue of *Town and Country Planning*.

Blackpool

This number goes to press just as the arrangements for the Blackpool conference are being completed. The list of delegates is already longer than that for 1950, and the papers, now being printed for advance distribution, are of exceptional interest. Altogether, the Blackpool conference looks like maintaining with ease the standards set by any of its predecessors. In our next issue it is hoped to review the sessions in a new way and before the end of the year the complete *Proceedings* will be published as a separate volume.

N. S. A. S. Christmas Card

For “public relations” purposes the Society is preparing an attractive “smokeless air” Christmas and New Year card. It will be suitable for general use and copies can also be supplied to members and representatives.

The card will be a folder, about 5½ in. by 4 in., on the front of which will be the reproduction of the painting from the Wallace Collection, “Castle on a River in Holland,” that appeared in the Spring, 1951, issue of this journal and which pleased many readers. Inside will be the conventional greetings, facing our familiar Wordsworth quotation.

The card will be sold, with envelopes, at 3s. 9d. for six, or 7s. per dozen, post-free. The number to be printed will be limited to that known to be required and orders should be placed not later than 31st October.

Do not delay to take advantage of this novel way of assisting the Society and its publicity and of solving your own Christmas card problem easily and inexpensively.

Stoke Orchard

The N.C.B. Central Research Establishment

THE cars met us at Evesham station and took us southwards, in the direction of Cheltenham, to the quiet village of Stoke Orchard. Across the fields was what had been a wartime aerodrome, and here were some of its buildings being put to important new uses. At first it seemed odd to find a national coal research establishment in the heart of the Gloucestershire countryside, but there are good reasons for it. First, it makes excellent use of existing buildings; and secondly it lies conveniently between the important coal-fields of South Wales and the West and East Midlands. And, it may be surmised, there may be advantages in a national establishment of this kind being outside any particular N.C.B. Division.

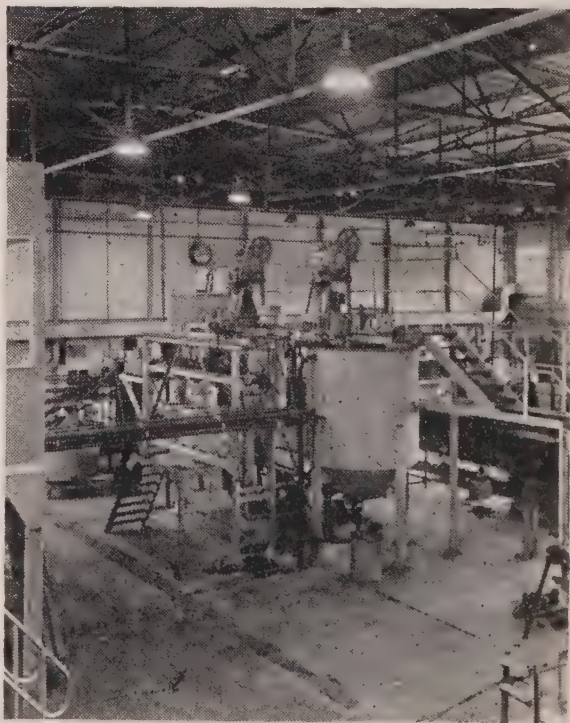
The occasion of the visit was in representing the Society with a party of members of the Parliamentary and Scientific Committee. Mr. Philips Price, M.P., Chairman of the Committee, led the party, which was welcomed by the Director of the Establishment, Dr. J. Bronowski, and the Deputy Director, Dr. D. C. Rhys Jones, and after lunch with the principal officers and department heads, a good four hours was spent in what proved to be an exceptionally interesting and stimulating inspection.

No such central organization, concerned with practical problems in the mining of coal and its preparation for the market, existed before nationalization, but from what was seen and learned during the visit, the organization, though young, was mature, busy, and confident, and doing work of high importance.

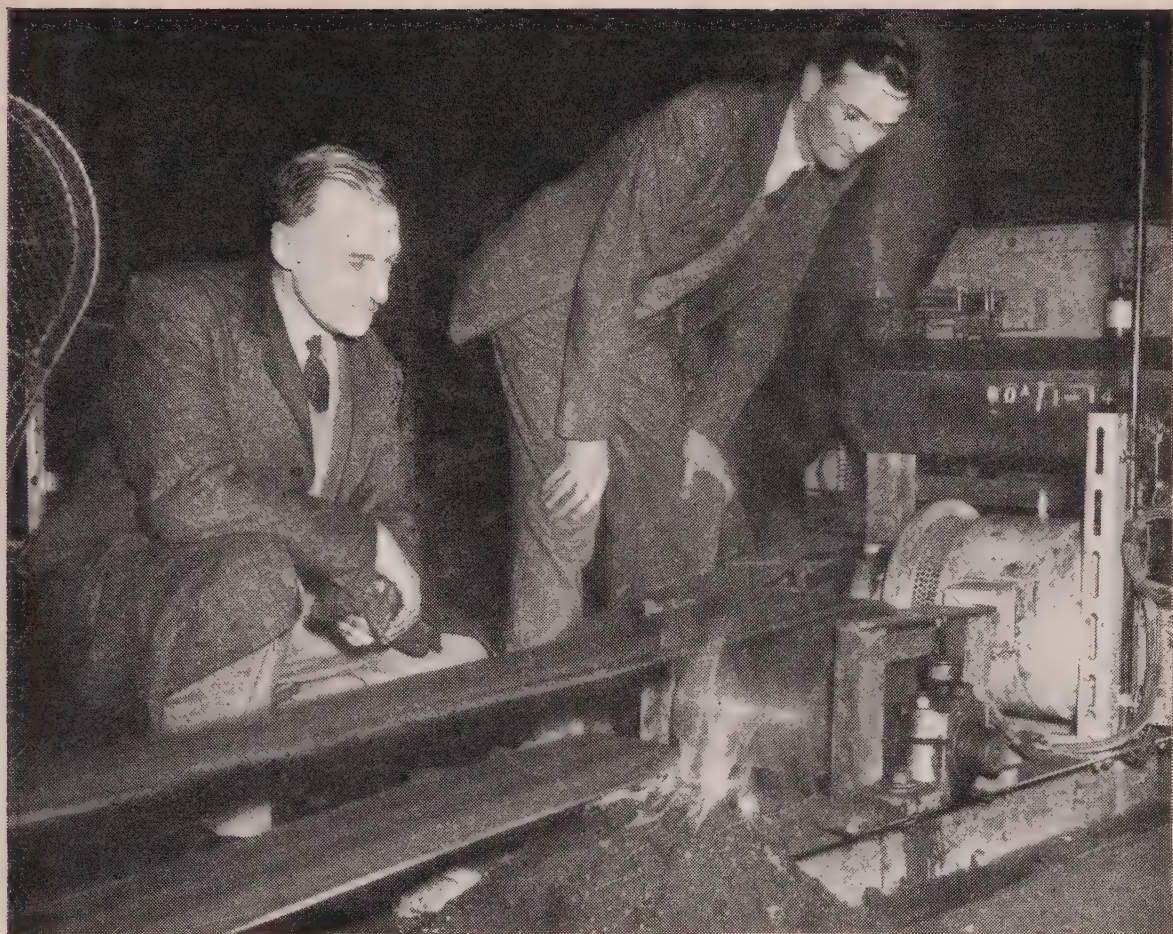
It certainly has a full programme, covering a remarkably wide range of problems. Thus, for instance, there is an investigation to determine how

conveyor belting catches fire and how to prevent once and for all disasters originating in such fires, as at Cresswell. This is a safety problem, which has top priority at Stoke Orchard, and already important conclusions have been reached. Another potential source of danger is the wire rope from which the cage is suspended. The testing of ropes, and warning of any weakness has hitherto been possible only through visual examination, and the research now in progress, though still at an early and theoretical stage, will, if it is successful, aim at developing an automatic warning system based on the fact that the magnetic properties of a steel wire vary with the tension upon it.

In the physics laboratory was seen work being done on the breaking of coal—superficially a simple and obvious operation. When coal is broken into whatever sizes are needed, a great



In the Coal Preparation Laboratory: the 2 ton per hour pilot plant



Experimental work to eliminate the causes of fires in underground conveyor belts

deal of it goes into unwanted sizes and dust. Any new technique in coal breaking that would reduce these losses would be economically valuable. On preparation again, much is being done on the cleaning of coal, including a detailed study of the physics of the froth flotation process and the designing of a mobile froth flotation unit that can be set up anywhere.

Another interesting demonstration was the use of rotary drills for drilling in rock. The efficiency of this type of drill, compared with the usual percussive drill, was convincingly shown. The Establishment has developed a special type of hollow drill which achieves exceptionally high rates of penetration and freedom from dust by removing the drillings through the hollow drill rod itself.

Smokeless Fuel Research

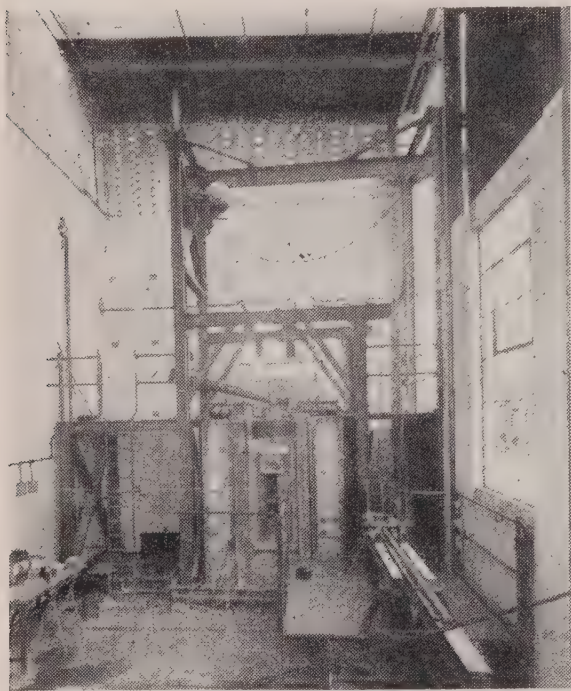
By coincidence, an article on the natural smokeless fuels of South Wales

with references to "Phurnacite," appears on another page. Here at Stoke Orchard we saw work being done to determine what other coals can be used in the process, and on developments in the operations by which the Phurnacite ovoids are carbonized to drive off the pitch binder to make them smokeless. A standard gasworks type of vertical retort is being used in these experiments.

There is also interesting work on the production of coke suitable for domestic purposes, using different blends of coal under coke-oven carbonization conditions, and on blending coals for metallurgical cokes so that the special coking coals—now growing scarcer and more valuable—may be used with the more abundant coals of lower coking quality.

Large size ovoids for industrial purposes are the subject of other research, and the growth of the use of such fuels would help to put to good

use the plentiful fines and dust, and even perhaps some of the waste now accumulating in spoilbanks.



Simon Carves large test oven in use at Stoke Orchard

One of the most interesting features of the tour of the Establishment was an inspection of a dummy pit and hundred-foot long model coal face. This simulates the real thing most realistically. After entering through a pressure chamber one is obliged to crouch along under the low, propped roof, in overalls and with a miner's lamp fixed on a white helmet, over an uneven coal-dust covered floor. The purpose of the model is, of course, to enable apparatus for use in the mines to be tested under conditions approaching as nearly as possible those found in actual working.

It is difficult, in so short and cursory a report, to convey the overall impression with which such a visit is concluded, but it can be said that in this case, in addition to gratitude to those who so patiently explained so much, there was a sense of appreciation for the work being done and respect for the way in which it was being tackled.

Butane as Town Gas

To meet the gas needs of small towns and villages which have either never had a public gas supply or have been dependent on small works equipped with old-fashioned hand-charged horizontal retorts, experiments are being made with the distribution of butane, a valuable product of the oil refineries, through normal mains and services. In many cases long distances rule out bulk supplies of coal gas from larger works, scarcity of labour makes it increasingly difficult to man hand-charged plant, and high costs, coupled with limitations on capital expenditure rule out extensions for which no early return can be anticipated.

Although butane has long been one of the bases of the "bottled gas" industry, its distribution through the mains and services of gas undertakings is a new development in this country, but the practice has passed beyond the

experimental stage on the continent. During the past winter the Wales Gas Board used butane to meet emergencies due to inadequate plant at Abergavenny, and a more extended test is to be carried out in a South Wales village where a section of the district is already served with town gas. Three plants are on order for Wales, the first of which is likely to be put to work in the near future.

Simple and effective machines can be installed in small ground space at comparatively small capital outlay. Running costs are low and labour costs become almost negligible in comparison with gas making in horizontal retorts. Smoke and dust are eliminated, as is the necessity for the disposal of gasworks effluents. The process is suitable for intermittent or continuous production, and plants can be made completely automatic.

Farms Near the Smoke Belt

The Black Sheep of Saddleworth

The following article, by "W.S." appeared in the "Oldham Evening Standard," and is reprinted by kind permission. It describes an aspect of the smoke problem not always borne in mind—the difficulties that arise in those areas (and there are many in the north and midlands) where farming is still carried on around and between areas of heavy pollution.

INDUSTRY, young as it is compared with man's oldest pursuit, agriculture, behaves not unlike a growing cuckoo chick—swelling in its borrowed nest, kicking and pushing around unceremoniously, breaking down all obstacles that stand in its way.

In an industrial town like Oldham too much is being taken for granted, and our memory is appallingly short. How many of us care to remember "how green were our valleys," how many realise that trees used to grow, not so very long ago, where tall chimney stacks now stand?

Industrialization is an incontrovertible process, but let us at least remember, as we go along the streets, gazing at the goods displayed in the shop windows, that not all the butter we buy comes from New Zealand, not all the beef from Senor Peron, not every egg from Denmark or Poland.

In fact, let us remember that not a half-hour bus ride from our humming factories men still go about the hundred and one jobs that are to be done on the land, as their fathers did for generations before.



The other day I made a little trip out of Oldham to see for myself how the farmers are doing in this mainly industrial part of the country.

The low-hanging black clouds shed rain and soot on to the grimy streets. The few people who had to be out were hurrying along looking wet and miserable.

But as the bus was slowly winding its way towards Uppermill, the difference in the atmosphere was striking. And I do not mean only

the air, so much cleaner and fresher, to be sure.

In spite of the rain, the whole countryside was humming with busy life. Here a heavy farm horse, let out on a bit of pasture obviously enjoyed taking a shower that would wash away the sweat of his toil; there a black tractor was sneezing merrily as it crept uphill with some late job of work to do; near-by a herd of black-and-white cattle were grazing and I could almost read from their usually expressionless faces the relish with which they sheared the succulent grass with their rough tongues, after their dull fill-belly ration of the long winter months.

When I knocked on the door of No. 9 Heathfields Road, thin trickles of rain poured down from the brim of my hat, but I remembered on whom I was calling, so instead of uttering the townman's "beastly weather" greeting I remarked to my host that this break in the prolonged dry spell must have been to his liking.

Councillor Hopkinson, who is secretary of Saddleworth Farmers' Association, readily agreed that the "spot of rain" is now most welcome on the farms.

When we settled down in front of the glowing fire (on this May morning) I asked him how the farmers fare in such proximity to industry.

"You must have noticed that all the sheep around here are black," said Mr. Hopkinson, "Well, not all are born black, though our farmers rather avoid the white variety nowadays.

"And very often, after a farmer has been in the fields all day, when he

comes back at night anybody could mistake him for a miner . . . Smoke is our greatest enemy."

Mr. Hopkinson, who is a grandfather, as I learned from a fair-haired imp of a girl peeping inquisitively from behind the door, remembers the dense woods north-east of Blackley which he used to explore as a boy. Now the smoke from factories has changed all this into desolate, barren ground.

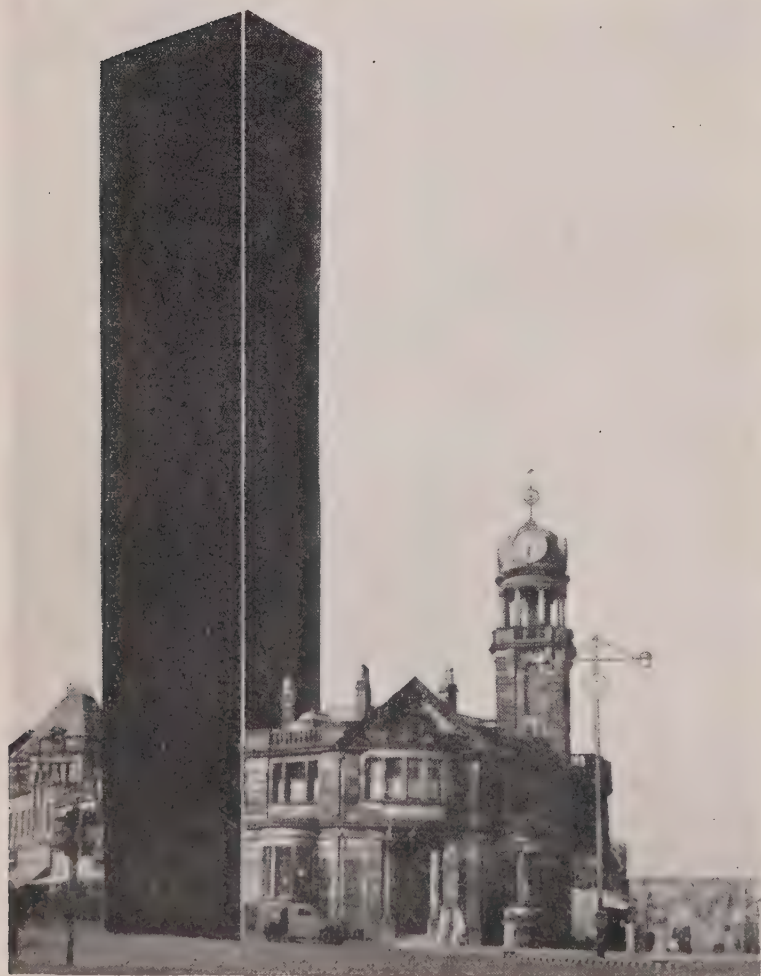
At one time he used to be on the Smoke Abatement Committee, so he knows what he is speaking about.

"But what can we do with the present fuel shortage?" he continues. "Take Springhead. The small leather works there eke out their meagre fuel allocation with refuse. It constitutes as much as 15 per cent. of their fuel—not an inconsiderable amount. We

cannot very well expect them to burn pure anthracite, even if they could get all they wanted."

With the prevailing southerly winds all the farmland north of Manchester industrial region (there are about a hundred farms in Saddleworth alone) are up against atmospheric pollution. Lime is the only salvation and even with the present price of 54s. a ton, with the Government refunding half of it, a farm of about 20 acres would use as much as ten tons of lime in the three-year rota.

"But just now," says Mr. Hopkinson, a grave note in his voice, "we learn that the lime subsidy is being taken off by the Government. In this district, where the ground gets so highly contaminated, it is nothing short of a calamity."



Nelson's Column

An exhibit from a recent Hygiene Exhibition at Nelson, Lancs. The black column shows the amount of atmospheric deposit falling within a half-mile radius of the town centre each year

Some New Publications

IT is always a pleasure to mention a book by a member of the Society, and especially if it is one that gets to the very heart of the smoke and fuel problem as does, in several of the essays it contains, **The Neglect of Science**, by Dr. F. E. Simon, Professor of Thermodynamics, University of Oxford. (Basil Blackwell, Oxford, pp.138, 8s. 6d.). For non-scientific readers it should be pointed out that the volume is described as "Essays Addressed to Laymen," and that these, for the most part, appeared originally in *The Financial Times*. Five of the essays are on fuel and power, and especially do we commend for close attention those entitled, "Why Waste Coal?" "Economical Heat Production," and "Wanted: a National Fuel Policy." The last was discussed in a recent issue of this journal. We will quote one extract, not only because of what it says, but to show how clearly and tersely Dr. Simon makes his points:

"Now open fires have an efficiency of only about 15 per cent.; they are 'contraptions to heat the stars,' as someone has said, and he might have added 'to soil the earth.' On the other hand, central heating installations are about 70 per cent. efficient, and simple closed stoves about 40-50 per cent. Thus it should not be difficult to save, say, 20 million tons of coal each year simply by abandoning open fires, at the same time actually improving the general standard of domestic heating. If one considers the (really most efficient) way in which the open fireplace contaminates our houses and towns, there is an unanswerable case for the elimination of open fires as soon as possible.

"The objections to this course are mainly sentimental; most people like open fires, just as small boys like the puffing noises and fumes of the old-fashioned locomotive. This love of

squandering seems to be deeply rooted, but we *must* overcome it. The reward would be very significant. Twenty million tons more coal per year might change the whole outlook for this country. The penalty if we fail could be severe; it might force upon us the most unpleasant way of saving—namely, going short of power and being compelled to sit in cold rooms."

Three "H.M.S.O." publications are on the list, but the first of these, **Eighty-Seventh Annual Report on Alkali, &c., Works** (for 1950) has so many points of interest to the N.S.A.S. that a more extensive review is given on another page.

The Ministries of Works and Local Government and Planning have published **Housing Manual 1949: Technical Appendices** (H.M.S.O., London, 1951, pp.86, 2s.). This is an excellently arranged practical volume and Appendix F, on "The Heat Installation" will be of direct interest and concern to many readers. It covers heat loss considerations, hot water services, heating more than one room from one appliance, running costs, performance, installation, flues, and air supply. There are also sections on district heating and electrical installations.

District heating is also dealt with in a short booklet of the Ministry of Local Government and planning, **District Heating Working Party: Interim Report** (H.M.S.O., London, pp.16, 6d.) This is confined to two questions investigated by the Working Party, namely, the probable effect of district heating on the quantities of water to be supplied by water undertakings, and the division of responsibility between water undertakings and district heating authorities. It is concluded that hot water consumption in dwell-

lings supplied from central sources will be about double that where individual methods of heating are used. If, however, each dwelling has a separate calorifier (heat exchanger) the amount of hot water used will be only about half as much again. Further cold water consumption tends to increase with an increase in hot water consumption, the amount being largely dependent on the temperature of the hot water.

From the Gas Council comes a well-illustrated brochure in the "Commercial Uses of Gas" series: **Gas and the Warming of Large Buildings**. (Gas Council, London, pp.26, 4to). This describes the various ways of using gas for warming—and there is a surprising number of different methods and variations available—with information on control, sizes required, cost, and so on. Photographs of actual installations show what can be done, and there is also a useful glossary of technical terms.

Methods of Reducing Dust Emission

from a Spreader-Stoker-Fired Boiler Furnace. By W. C. Holton and R. B. Engdahl (Bituminous Coal Research Inc., Pittsburgh, pp.9, 4to., 20 cents.), is a reprint of a paper read to the American Society of Mechanical Engineers. It describes tests carried out at the Battelle Memorial Institute on a continuous-ash discharge spreader stoker-fired boiler to determine means of reducing dust emission. In addition to burning rate, variables investigated were the amount of overfire air, the use of air, steam, and steam-air jets, the location of steam jets, the degree of reinjection used, and coal size. The tests showed that the use of overfire-jet turbulence decreased smoke density, carbon loss, and dust emission from the furnace. It was found that steam jets located low in the rear wall gave the lowest dust emission. Reinjection of all collected cinder decreased carbon loss to one fourth of its value without reinjection, but doubled the dust-loading of the stack gases. The use of double-screened coal was found to reduce dust emission appreciably.

The Society's Divisions

Summer is no close season for the Society's Divisions. On June 19th the **East Midlands Division** visited the Staythorpe Generating Station. Apart from the inspection of the station there was a lunch, an official welcome to Southwell Rural District by Lt. Col. G. H. Vere-Laurie, Chairman of the R.D.C., and to the power station by Mr. E. H. Taylor, Station Superintendent. Mr. Taylor gave an address to the members on "Smoke Abatement in relation to the modern power stations."

An inspection, by river steamer, of the Tyne, was one of the features of a meeting of the **North East Division**, on July 6th. In the morning the annual general meeting was held and a paper on Smokeless Fuels was read by Mr. W. A. Lloyd Dodd, of the Northern Gas Board. An alternative

to the river trip, which was by invitation of the Tyne Improvement Commissioners, was a visit to the Dunston Power Station.

The **Yorkshire Division** met on August 1st at Rotherham, where members were welcomed by the Mayor, Alderman Shayler, J.P., and were entertained at lunch by the Corporation of Rotherham. In the afternoon a visit was made to the Templeborough and Ickles Works of Messrs. Steel, Peech and Tozer. Here the members were shown what had been done by the company for the reduction of atmospheric pollution, particularly in the melting department, the cogging and bar mills, the press shop and the wheel department. Members were entertained at tea by Messrs. Steel, Peech and Tozer.

Smoke, Dust, and Efficiency

by J. Fallon, J.P., M.I.Mech.E.*

THE public generally are inclined to regard air pollution as the form of contaminant they can see, i.e., smoke and fumes from industrial processes, their domestic fires and so on.

It is not generally appreciated that the weight of the atmosphere is about one ton per sq. ft. and that each sq. mile of land supports 28,000,000 tons of air. If you can imagine wind blowing up at, say, 20 miles an hour over Smethwick, with its 3.9 sq. miles or 2,500 acres, in the course of an hour some 2,240,000,000 tons of air would pass over our famous Borough, i.e. enough air to burn completely the entire annual output of the coal mines of Britain in just one hour. Thus it will be conceived that Nature operates in a big way, and it is natural that mankind from the earliest beginnings of industrial effort relied on the stupendous dispersal power of this atmospheric ocean to clear away, disperse and dilute any form of contaminant which he found it most convenient to discharge into it and which would be dispersed and carried away by it.

I know that it is dangerous to make general statements because many exceptions may be found, but as I understand the problem, the degree of atmospheric pollution even in industrial cities, i.e., dust, smoke and obnoxious fumes, is usually in such low concentration (i.e., 0.4 to 1.0 grains per 1,000 cu. ft.) as not to impair the health of ordinary healthy citizens living within these areas to any measurable degree. It is true, of course, that in cases of bronchitis and other diseases of a like nature contaminant dusts may irritate and

aggravate such complaints, as against the purer atmosphere of the country or seaside.

I have touched upon the effect of normal concentration of contaminants in industrial areas on health and the effect of these contaminants on buildings, general property and on machinery, as well as upon plant life, is of serious consequence. Perhaps from the health point of view the main effect (and here I hesitate to express opinions when medical authorities are present) is in the obscuration of light and particularly sunlight and health giving ultra-violet rays, the lack of which tends to promote rickets and other diseases. In other words, the main danger to health is through indirect rather than direct effect. The point I wish to emphasize is that relatively transparent and in many cases odourless gases, which are not visible pollutants, may be present in concentrations which are far more damaging to health and property than visual contaminants such as smoke.

Airborne dust and grit enters the bearings of every type of machinery causing rapid wear and tear and loss of accuracy or precision due to its highly abrasive properties. Such gases as sulphur dioxide, flourine, in their condensed form are very vigorous in their attack on all kinds of protective coatings. I remember one occasion when dust and rain collectors were placed between Smethwick and Wolverhampton. These were lined with zinc sheet and a considerable proportion of the zinc was dissolved in the rain collected, which was strongly acid. Also, I remember on another occasion with Dr. Owens that a certain plant in Smethwick, which has now been removed, poured out dust in certain areas at a rate of 14,000 tons per sq. mile per annum as compared with Salford, Manchester, an average of, say, 600 tons per sq. mile per annum

*Excerpts from a Paper "Smoke and Atmospheric Pollution Abatement in Relation to Fuel Efficiency" read at a meeting in Smethwick on June 7th, 1951, to the Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution.

dust settlement.

Statistical data now available through the great improvement in our measuring instruments forms a valuable base for considering the problem generally. In the final analysis, however, the problem can only be tackled effectively at the source, i.e. the points at which contaminants are generated and discharged into the atmosphere or otherwise precipitated or collected. Over 200,000,000 tons of bituminous coal are burned annually in Britain, and in mid-winter the consumption probably reached something in the order of a million tons a day of a fuel containing volatile material, which is the main smoke-forming element. It so happens that this volatile material has the greatest heating value in the fuel, therefore the correct combustion of coal with the right amount of air will give the greatest efficiency and heat release, and with modern combustion equipment smokeless combustion is possible under widely varying load conditions.

The Domestic Fire

The ordinary domestic fire, is, of course, a great offender. Its efficiency is extraordinarily low and its smoke-producing properties high. Much work has been done by the British Coal Utilization Research Association and other organizations on improvement of combustion conditions in the ordinary bituminous-fired domestic grate. The ultimate answer to this, of course, is the conversion of coal into gas and coke and the condensation of certain elements of the volatiles into valuable by-products, the whole of which processes, both in the formation of gas and coke in the utilization of these refined fuels, is smokeless. The elimination of smoke as such does not necessarily indicate that efficiency has been increased, because excess air, which under certain conditions will eliminate smoke may cause great waste of heat energy. It requires twice as much heat to heat a ton of air as compared with heating a ton of steel. Excess air in industrial furnaces often causes great damage

by scaling of metals and impairment of their properties through intercrystal oxidation, and so on. With modern combustion equipment automatically controlled large scale industrial processes involving the combustion of volatile fuels can, however, today be carried out without visible contamination of the atmosphere.

The increased use of low grade high ash bituminous coals, as for power generation, however, constitutes a most serious problem, due to dust discharge.

In dealing with dust we usually define the size of the dust particle in microns. A micron is one thousandth of a millimetre or one-twenty five thousandth of an inch diameter, not visible to the naked eye. In fact, the smallest particle visible to the naked eye is about 10 microns diameter, or one thousand times greater volume than a one micron particle. Smoke is really a form of dust and a particle of smoke, say, from your cigarette may be less than half a micron diameter. You can observe for yourselves how these very small particles drop to the surface of the earth by gravity.

Perhaps I have said enough to indicate that the real line of attack should be to prevent emission of smoke, dust and fumes at the nucleus, or source. More particularly should this be the case, because at the point of generation, concentration of these dusts and fumes are such as are in many cases most definitely injurious to health.

Silicosis

Take, for instance, silicosis—silica dust in the mining and quarrying industries. Very fine particles of silica enter with the air into the lungs; perhaps the finer particles are more injurious than the heavier particles, because it is believed by medical authorities that this very fine silica dust is sometimes dissolved by the body fluids and promotes fibrosis and other effects which are permanent. Take lead dust, for instance. Once lead penetrates the system it never leaves it, and the most deplorable, degenerative effects are promoted by such dust.



Mr. J. Fallon

Carbon or smoke in itself is not so injurious because carbon is a chemically neutral material (neither acid or basic), and you know you can even eat charcoal biscuits which contain a lot of carbon without detriment to, and with what some claim to be an improvement of, the digestive processes, although I doubt it, and I would not advise anyone to eat lumps of coke.

Grinding operations, spraying operations, combustion operations with blast, which promotes fly-ash and melting of iron in cupolas, all promote dust, and whilst dust collectors are fitted compulsorily to a lot of this apparatus, very often the dust is discharged into the outer atmosphere at low levels, merely removing intensive concentration at one point to less intensive, but nevertheless dangerous zones of concentration nearby.

It is fair to state, however, that practically every form of dust and fume emitting process can be dealt with by modern apparatus; dry filters, wet filters, mechanical filters, washing plants, electrostatic precipitation and so on. There is, of course, the important question of economics in the application of all these forms of equipment, but generally, as a cardinal principle, those who create dust and

fumes should be responsible for and pay for their prevention and removal. Failure to do this means that those not concerned so directly with these processes often suffer from the consequences of avoidable pollution by way of depreciation and impairment of health, property and comfort. The present shortage of manpower and materials is retarding many schemes for tackling these problems.

A Summary

Summarizing the foregoing, I do not think the following statements require qualification, when I say that :

(1) In most problems of atmospheric pollution and contamination the degree of pollution and contamination can be reduced to negligible or harmless concentrations by apparatus at present known in use and designed by this great variety of problems ;

(2) The introduction of such apparatus is largely a question of economics, plus availability of manpower and materials particularly at this time ;

(3) The elimination of pollution and contamination should be a first consideration in every industrial process, in so far as it affects the health of the workers involved and the comfort and health of the public in the immediate affected areas ;

(4) The removal and prevention of such atmospheric contaminants is, in most cases, a paying proposition, because apart from the human side, such reduction must inevitably reduce corrosion, erosion, wear and tear of buildings and machinery. Further, in many cases, contaminants so precipitated and collected are of considerable economic value ;

(5) The industrial undertakings and the public generally should co-operate with each other and with the authorities concerned in all these matters, because it is no use weeding your own garden, or it is difficult to keep it weeded, if the fellow in the next garden allows his dandelions to seed.

(6) Everything which can be done to promote public interest and effort in

(Turn to foot of next page)



From our Photo-Library—9

Portrait of an Ei

J. Fallon—concluded

these matters is of the highest importance in relation to our national economy, health and efficiency.

(7) I would perhaps fail in the purpose in which I set out in preparing this short paper if I made no mention of new developments and the outlook for the future.

Recent experiments have indicated that there is an encouraging prospect that the use of sonic and ultrasonic vibrations, producing powerful sound waves or vibrations, varying in frequency from 5,000 to 50,000 per second, have a powerful effect in the agglomeration of fine dust particles, the precipitation of smoke, various types of fogs, including water, Sulphuric acid, etc., and other pollutants in cold or hot gases.

It is claimed that units suitable for

dealing with volumes of air or gases up to 100,000 cu. ft. per minute are now practical and that capital and operating costs are economical, as compared with other processes.

We are just beginning to appreciate the important effects which may be produced in gases, liquids and solids by excitation by high frequency vibrations. Much work is being carried out in Great Britain and U.S.A. on this important subject with encouraging results.

(8) It is only by persistent long term propaganda, Public spirited effort and co-operation, appreciation of the causes and remedies and a determination to make this a brighter, happier, healthier and still pleasanter land, that we will realize these worthy and worthwhile objectives.



Photograph by Aerofilms Ltd.

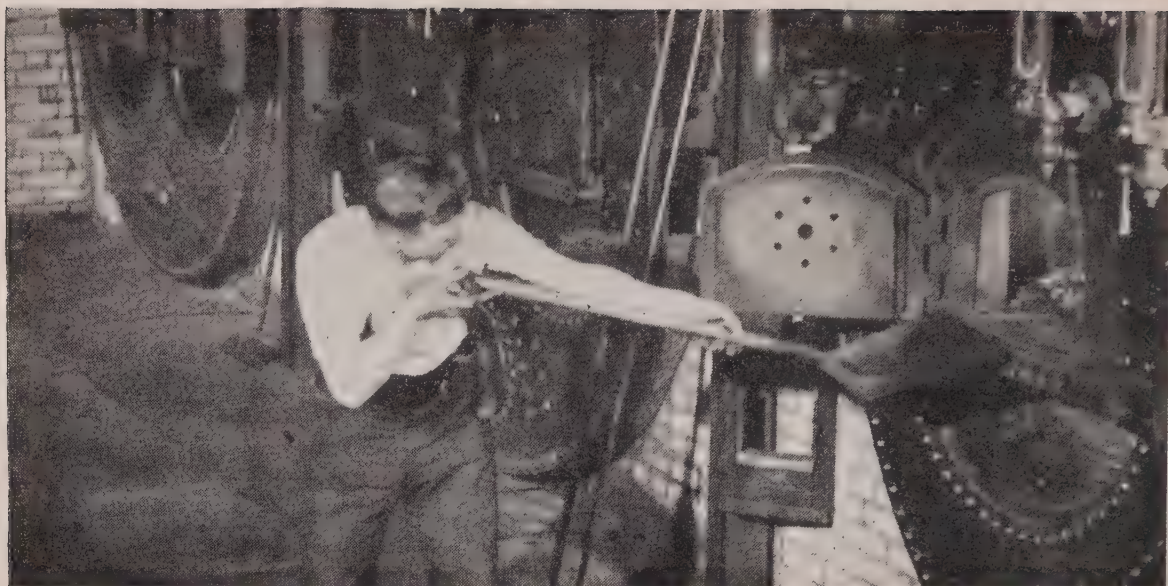
ish County Town

THE FOG LOAD

Mr. F. M. Birks, in his Presidential Address to the Institution of Gas Engineers in May last, made an interesting reference to a consequence of the gradual freeing of London from "smog."

"It is most informative to find," he said, "that the former Gas Light and Coke Company, during the early years of the century, did not have to install any gasholders for some 33 years, when the change of consumption from lighting to heating set in, which is the more remarkable as over the same period the consumption grew by over 60 per cent. It is not generally appreciated what a large capacity of holders was required to meet the massive impact on consumption that the 'pea soup' fogs of the latter end

of the 19th century had on the then high-percentage lighting load by extending drastically the hours of usage. Persons like myself have watched through this century the gradual emergence of London from a coating of funereal black to the sparkling beauty of its old buildings now restored to their original appearance, thanks mainly to the efficiency of both our own and the electrical industry in the cleaning of the air. Here I would like to pay tribute to our Cinderella, because it is possible that the solid fuel industry might not have so energetically prosecuted the search after more efficient household grates had not devoted workers in our own industry been so successful in leading the way to the efficient utilization of coke."



Education, Smoke Abatement and Fuel Efficiency

By S. N. Duguid

(Chairman, Executive Council)

ONCE upon a time, a bright lad, naturally a member of the smoke abatement movement, had a brain wave. He suggested that if the men stoking fuel-burning plant such as steam boilers, furnaces, etc., were trained for the job, the result would be less smoke and a saving in the weight of fuel burnt. This idea was taken up in Manchester and Glasgow and classes established at that time (the year 1909) are still going strong in these two cities.

Other industrial centres followed suit and during the last world war this educational movement received considerable impetus from the activities of the Education Committee of the Ministry of Fuel and Power and classes suitable not only for stokers, but for engineers and others associated with fuel burning plant were organized. A huge mass of information, of value to everyone concerned with the use of fuel was accumulated and made accessible

to all and sundry. The material included two textbooks namely *The Efficient Use of Fuel* and the *Efficient Use of Steam*; the *Stoker's Manual*; *The Furnaceman's Manual*; numerous bulletins; four instructional films; film strips; lantern slides; wall diagrams and lecture notes. This store of knowledge is still available to all who ask for it.

What are we going to do about it? My suggestion is that we should help to construct the channels down which the accumulated wisdom may flow so that it may be on tap in all regions where there are people to absorb it. To leave it buried in the archives would be folly.

In every industrial area there is need for instruction of this kind and the purpose of this article is to appeal to readers to use whatever influence they may have to establish classes suitable for their districts and to encourage men to attend.

The best place at which to give this instruction is, in the opinion of the writer, the local Technical School or College and the best time, under present circumstances, is during the winter evenings. The part-time winter sessions usually commence at the end of September or the beginning of October so no time is to be lost if any action is to be taken this year. Suitable syllabuses for the classes are contained in a handbook issued by the City and Guilds of London Institute, 31 Brechin Place, London, S.W.7, entitled "Regulations and Syllabuses for Examinations in Mechanical Engineering and Allied Subjects," price 1s., by post 1s. 3d. The Regional Fuel Engineers of the Ministry of Fuel and Power are always ready to assist in securing the requisite number of students, and in many other directions.

Our Technical Schools, in the evening, are crowded. More space, more equipment, more teachers are required to deal with the increasing number of men and women of all ages who wish to equip themselves for the job they

have chosen. These men and women come from all walks of life but the bulk of them belong to the working people. A glance down the subject index of a modern technical school proves that there is a demand for instruction in an astonishing number of diverse subjects, joiners, gas fitters, plumbers, welders and bricklayers are catered for, in fact, everybody under the sun but, except in rare cases, the attendants of fuel-burning plant.

The reason is not far to seek. Stokers, for example, are still regarded as unskilled labourers although their job calls for a considerable amount of skill if it is to be done efficiently. It is not always realized that a stoker firing two Lancashire boilers may easily be spending over £5,000 of the firm's money in coal per annum. Is this a job for the uninstructed? Until we say and believe that nobody but a trained man should hold a responsible job in connection with any fuel burning plant (above a minimum size) progress in educational matters will be painfully slow.



Learner : This is one of the world's worst jobs !

Old-Timer : Cheer up ! Think of the prospects in the next !

Stoking is a skilled job, but as long as anyone with sufficient strength to shovel coal is allowed to do the work, it will always be regarded as an unskilled occupation.

A course of instruction, followed by a written examination and also a practical one on the firing floor, would give the stoker the status he deserves. This matter is at the present time receiving the attention of the Boiler House Practice Advisory Committee of the City and Guilds of London Institute, and it is hoped that some scheme, on a national basis, will emerge.

In the meantime, every stoker who attends instructional classes and passes the examinations at present open to him, is not only serving his country well in this time of fuel crisis, but is hastening the day on which he will be recognized as a skilled operative.

Hints on the Running of Classes

The writer's experience in the running of classes of the kind advocated in this article has been gained at the College of Technology, Manchester, where they are well established under the title of Boiler House Practice I, II and III. These correspond with the City and Guilds Preliminary, Intermediate and Final grade, and the syllabuses are those detailed in the City and Guilds Handbook.

The number of enrolments has varied from 25 to 95 for the first year, 35 to 80 for the second year and 12 to 25 for the third year. Men of all ages from 18 to 65 years attend. The older men make the best students. Attendance is not restricted to men who actually handle fuel burning plant.

These classes make a much wider appeal than is sometimes realized. Besides Stokers and Engineers, they attract Draughtsmen, Cost Clerks, Salesmen and other employees of Boiler, Furnace and Instrument Makers, also of Heating and Ventilating Engineers, and Coal Merchants.

Boiler House Practice II or the Intermediate Grade syllabus is approved by the Royal Sanitary Institute and those wishing to sit for their

Smoke Inspector's Certificate, are required to attend such a course. In Manchester, this second year class has always contained a substantial percentage of Sanitary Inspectors.

It is a great advantage if all these classes can be held in a room fitted with a chemical bench as this makes it possible to enliven the lectures by demonstrations involving the use of water and gas. A lantern and screen are indispensable. Film shows can be put on by arrangement with the Central Office of Information who are always pleased to help educational work of this kind.

Visits to neighbouring boiler houses of industrial concerns, or power stations, are appreciated. It is difficult to choose a time suitable for everybody but many will attend on Saturday afternoons if the local football team is playing away.

In the classroom the proceedings shall be as informal as possible, and questions invited.

A homework question should be set after each lecture to be answered in writing and handed in at the next meeting. The value of this is twofold. It develops the latent powers of expression and leads to clear thinking and also enables the lecturer to judge whether the class has understood what he has been talking about. If the class is large, the marking of these papers takes more time than delivering the lecture, but it is time well spent. Students who score high marks for their homework rarely fail in the examination held at the end of the season.

Employers can help considerably by encouraging their men to attend such classes. Many do this by paying the fee and any travelling expenses incurred, and some, in addition, pay the man for the time spent at the lecture, at his usual hourly rate.

Many men have gained financially as a result of attending these classes, but perhaps the greatest benefit received by all is that of increased interest in their work. You can get quite a kick out of the thought that you are becoming a master of your job.



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N.S.A.S. Photo

Un-Productivity



Cleaning London's soot from the Horse Guards Building—two of the army of men in Britain whose labours are diverted from all-important Production to cleaning up the mess made by the coal we have wasted . . .

THE RESPONSIBILITIES AND OPPORTUNITIES OF LOCAL AUTHORITIES IN INDUSTRIAL SMOKE ABATEMENT

From a Paper by Thomas M. Ashford, A.M.I.Mech.E., M.Inst.F.

ONE of the most interesting papers at the recent Scottish Division Conference in Inverness (May 24th-25th, 1951) was that by Mr. Ashford, Chief Smoke Inspector, Corporation of Glasgow. He listed the activities in which, in his opinion, all large local authorities should engage for smoke abatement and to make up the ground lost during the war. His list was as follows :

1. Statutory control by administration of the powers available.
2. Special and routine observation of the smoke emission in the area under control.
3. Surveying the technical changes in plant construction for industrial purposes, and assisting changes which are effective.
4. Supporting and organizing technical courses of instruction in combustion and plant management for operatives, and, if need be, executives.
5. Undertaking or assisting investigation and research into the problems connected with atmospheric pollution and smoke abatement.
6. Public education by propaganda and popular lectures.

As space does not allow the printing of the paper in its entirety we are, instead of summarizing, recording the author's detailed discussion on his first three points. The differences between the Scottish and English law that are touched upon will be of interest to English readers.

Administration of the Available Powers

In Scotland the adequacy of the powers possessed by local authorities to effect control of industrial smoke

leaves much to be desired. There is no general Act for the country as a whole, and such powers as are possessed are, in the main, obsolescent and are, in my opinion, unworkable. In sections of these many anomalies exist, particularly in adjacent industrial areas. England is fortunate in that there is a general Act—Public Health Act of 1936—which incorporates the Public Health (Smoke Abatement) Act of 1926. Under this general Act there is a large measure of uniformity of local administration. In Scotland, as stated, there is no such Act, and the only powers at the disposal of local authorities are those contained first in Section 16 of the Public Health (Scotland) Act, 1897, and Section 384 of the Burgh Police (Scotland) Act, 1892. This Burgh Police Act is more specific and applies to burghal areas. Five such areas in Scotland possess Local enactments and these have considerable variations in the powers they confer. For instance, under the Public Health (Scotland) Act, 1897, where a complaint is made, the complaining authority has to prove that the smoke complained of constitutes a nuisance and is deleterious to health. This is not so easy as it might appear at first sight and I am not aware of any successful action having resulted from the application of this Act. The powers conferred by it have been invoked by a number of Authorities, but the results were not satisfactory. The terms of Section 31 of the Glasgow Police (Further Powers) Act of 1892 are as follows :

“Every person who so uses, causes, permits or suffers to be used any furnace or fire within the city (except a household fire) as that smoke, grit, gritty particles, sparks,

ashes or cinders issue therefrom unless he proves that he has used the best practicable means for preventing smoke . . . being issued and has carefully attended to and managed such furnace or fire so as to prevent as far as possible smoke issuing therefrom" shall be liable to a penalty.

This is what I would consider a good and workable Act, and much good has resulted in the past where its powers had to be invoked.

Section 384 of the Burgh Police (Scotland) Act of the same year is in almost identical terms, except that it does not contain any reference to impurities other than smoke, and has exempting clauses so far as mines and certain other metallurgical processes are concerned which results in practice that just in those areas where effective control is necessary the processes likely to be involved are those which are purposely exempted, which means that in those areas the Act is inoperative.

Another point to be noted is that in both of these Acts and even under the General Act of 1897 no reference is made to the colour or density of the smoke, nor in the 1892 Acts is there any necessity to show that the smoke is in such quantity as to be a nuisance. It is simply stated that if smoke is emitted under circumstances where the best practical means and careful management have not been given effect to, then an offence is committed. The offence is the emission of unnecessary smoke.

Where furnaces or fires are operated there must, of course, be some smoke emission and it is in the interpretation of the powers available and technical limitations imposed on the practical working of furnaces that it is so necessary that ordinary common sense, plus technical skill, be exercised if the co-operation of the plant users or owners and operatives is to be obtained, much less a successful issue in any enforcement of the powers that might be instituted.

It is fortunate in Scotland that no reference is made to the term "black

smoke." Technically, of course, there is no such thing as "black smoke"; the word "dense" is always used. This word "black" had led to some trouble under English administration. Before statutory enforcement can be employed the smoke must either be a nuisance or also be "black smoke." It would also be noted from the Scottish powers available that there is no reference to the duration of non-permissible smoke. Here again local authorities are at variance. The standards vary north, south, east and west. Even Edinburgh differs from Glasgow, and I have no doubt that Dundee, Aberdeen, Perth, Inverness or any other area will show differences in conception in this regard. What is needed is a general Act covering the whole country, wide in its scope and application, yet giving closest guidance in the standards to be maintained and specifying the emission which would constitute a statutory infringement. In addition, other impurities should be included such as grit, sparks, ash and oily vapours. The report of the Committee on Scottish Health Services issued in June, 1936, agreed that existing legislation in this connection required amendment. If the ground lost has to be recovered and further progress made, then a general Act for Scotland cannot be much longer delayed, and I would suggest that it should follow the lines of the Glasgow Provision or an amended Burgh Police Act.

Special and Routine Observations of Smoke Emission

In only a few areas of Scotland is routine observation work of smoke emission undertaken, and in all other areas it is only when a particular chimney or plant occasions extreme local nuisance that special attention is directed to it. There are several reasons for this—first of all, in most areas outside the large cities the duties of the Sanitary Inspector and his assistants are of a general factotum character. He realizes that his time is fully occupied in attending to more normal sanitary operations. He, or

they, may also realize that if it is proposed to pursue an act of policy against smoke pollution, then special study and knowledge is necessary, and, apart from these considerations, the local official realizes the inadequacy of the powers at his disposal should he have to resort to legal action. It is to be noted, however, that in a number of these wide areas outwith cities proper, and in which there is a very considerable amount of industrial activity, special attention is now being focused on the aspect of atmospheric pollution, and more routine observation work is being undertaken by the general Sanitary Staff. Routine work is the only way in which the individual behaviour of chimneys and the conditions of plant can be noted, and it is very necessary information when the attention of plant users is directed to it. Probable faults in the methods of management can be detected, and in this way the active co-operation of the management can be gained and salutary remedial measures adopted. A lot of people are possessed of short memories, especially when convenient, and it could not be said that plant operators and executives are exceptions.

Legal action is not the primary function in the administrative control of industrial smoke. It is to be noted that even in Glasgow where this aspect of public health work is specialized and very active, the prosecution rate pre-war was less than one in forty of the warnings given. A successful prosecution should be of no interest to the Local Authority ; only the resolution of a smoke nuisance or problem. The main function of the local authority, acting through their officials, is the tendering of advice and assistance, and it is for that reason that local authorities, under administrative officers, must make themselves more fully conversant with the law as it exists and as it must be altered in the future, together with much of the technical details connected with administrative work. Only in this way can satisfactory administrative progress be made. Routine observation by local authori-

ties will also furnish information as to the general experience in connection with specialized industries, and this will or should have very direct bearing on the siting of many new housing areas. This is a very important point. In the past, all too many houses have been built in locations which obviously must be subject to local nuisance from surrounding industry. In many cases individual local nuisance even from a particular chimney is made, and this can make conditions almost intolerable. This is particularly so where process furnaces are involved. I can cite many instances where foreknowledge on the part of the Departments concerned would have avoided no end of trouble. The building of houses right against, say, iron foundries, certain types of chemical works, potteries, etc., is most undesirable, in fact, in my opinion, is simply ridiculous ; yet it still goes on. It is no use interested individual Departments or Authorities saying that nuisance must be stopped forthwith. Generalized nuisances are not stopped forthwith. It is, unfortunately, a long-term business. Routine observation would do much to obviate complications arising in this connection. Departments and local authorities must be administratively active, but also realists.

There are many points of administrative detail which cannot be recited within the scope of this short address.

Observations on Improvement in Plant

In the industrial field one of the functions of local administration is to note those improvements in plant which have made, or are likely to make, a direct contribution to the reduction of the aggregate smoke emission from the chimneys and plants with which they are connected, and to assist this movement wherever possible. The advice of the Officers of the local authority will often be sought in this connection, and they should be in a position to offer such advice when requested. All of the improvements, or so-called improvements, which a plant user might be induced to install

will have much practical bearing on the problem because in the past there have been too many gadgets offered for sale, some of which have appeared to be an easy way out of a set of conditions existing, the solution of which had to be entirely salutary. If the local authority, through its representative, is in a position to gain the confidence of the plant user, then, without being partial, he can recommend or discuss types of plants or the nature of an alteration that may be made that will have a lasting effect and lead to the ultimate solution of a particular problem. A manufacturer who has been wrongly advised, after relying on what he presumed to be expert advice, becomes a very disgruntled person, and his active sympathy and collaboration is largely lost.

The improvements that can be effected may come under the following headings :—

New steam boilers installed to give increased power.

New and modified designs of process furnaces to give increased heating capacity.

Mechanical stokers fitted to steam boiler plants, replacing hand firing.

Certain types of secondary air smoke preventors fitted to hand-firing furnaces.

Furnaces adapted for the combustion of oil fuel.

Steam boilers replaced by electric motors (using public supplies).

Furnaces in which gaseous fuel is substituted for coal firing, and steam boilers being replaced by I.C. engines.

Furnaces in which anthracite, coke, or other non-bituminous fuels may be substituted for the bituminous fuel.

Heightening of chimneys, straightening of flues, and attention to the thorough insulation of the plant.

This gives a general idea of the avenues of improvement which have been made in the past by plant users. The older and more inefficient methods of fuel combustion and power generators are non-economical, and compliance with the standard of smokelessness that was and will now again be demanded by public opinion and by statute requires that individual installations capable of high thermal efficiencies must be up-to-date. It is to be anticipated that much greater use will be made of gas and electricity for both heating and power purposes. In short, the local authority, through its officials, must keep itself *au fait* with plant improvement. The economic factor, as affecting the individual user, must not be lost sight of in the deliberations with him.

The Howden Multivortex Dust Collector

THE Howden Multivortex Dust Collector was developed to meet the demand for a collector which, while maintaining a high efficiency of dust removal would occupy less space than other types of collectors.

A diagrammatic sketch of a typical Multivortex Collector is shown opposite. The gas cleaning in this collector is carried out in two stages, firstly by a primary concentrator unit in which the dust is concentrated into a small portion of the total gas and secondly by a secondary collector

which removes the dust from this small portion of gas.

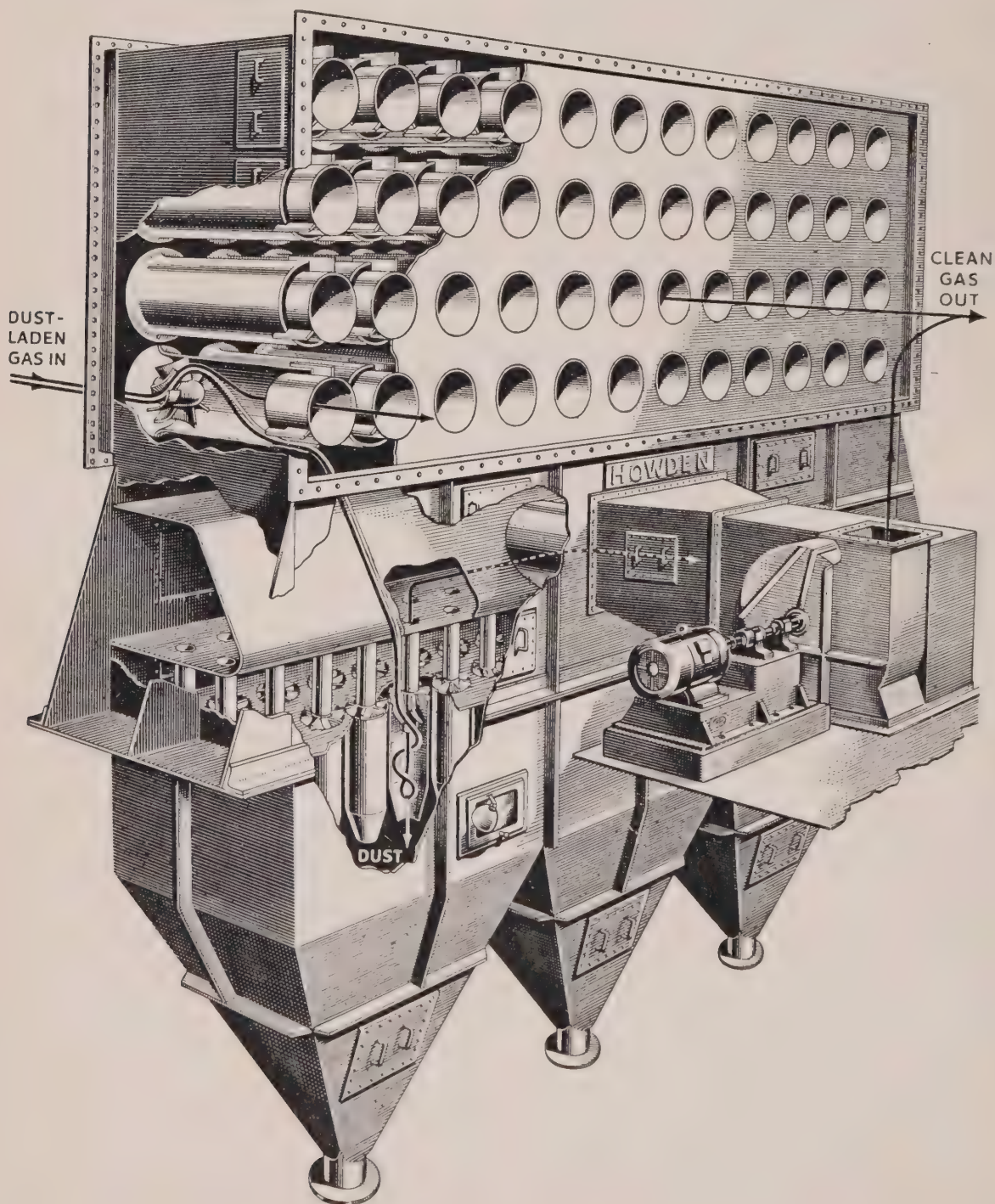
The primary unit consists of a number of horizontal tubular cells. The dirty waste gases and smoke from the boiler pass through these cells in the direction shown and in doing so are given a spiral spin by the vanes at the entrance of each cell. The resulting centrifugal force throws the dust into the layer of gas adjacent to the walls of the tube leaving the major portion of gas in the centre free from dust. This clean gas passes on through the

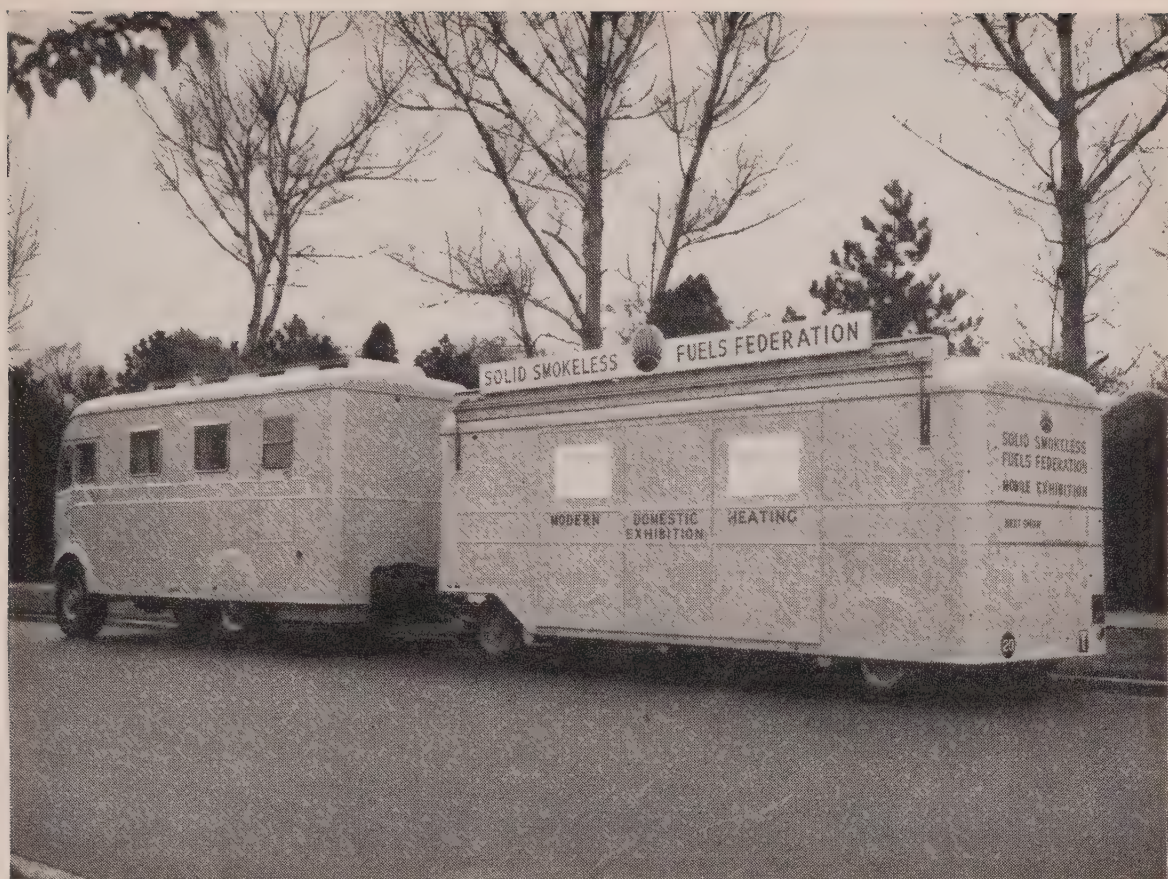
discharge tubes which are placed concentrically at the ends of the cells and is eventually discharged into the atmosphere. The smaller portion of gas now carrying all the dust passes through the annulus around the discharge tubes and flows into the secondary collector as indicated.

The integral secondary collector is a small high efficiency Centicell collector consisting of a number of vertical tubular cells. The gas in passing through the vanes at the top of the

cell is given a spin which throws the dust to the walls of the tube and it falls into the storage hoppers below. The cleaned gas is drawn up the centrally positioned outlet tubes by a small fan conveniently placed adjacent to the collector and returned to the main gas stream already cleaned by the primary unit.

(This description, and the diagram, are reprinted by permission from "Howden's Quarterly.")





A TRAVELLING EXHIBITION OF SMOKELESS DOMESTIC APPLIANCES

The adjoining photographs show a novel kind of mobile showroom that has been specially designed to demonstrate, particularly to country dwellers the latest types of domestic solid smokeless fuel appliances. It allows eight typical appliances, covering all the heat services in the home, to be on view. They include open fires and heating stoves, cookers, hot water boilers, some of them multiple-duty appliances which provide heating plus hot water or cooking plus hot water, and a combination grate for all three services. The outstanding feature of the showroom is that an appliance of each type can be shown alight. Experienced demonstrators will travel with the showroom.

The Solid Smokeless Fuels Federation have organized this travelling exhibition because it has been realized that in the countryside there is a great

need for more efficient heat services in the home which most often can only be met with solid fuel appliances. And people in the country have the least opportunity of seeing the new high efficiency appliances for heating cooking and hot water supply. These give a better and more economical heat service than old-fashioned appli-



ances in common use—with the very great advantage of being smokeless and sootless.

During the past summer the mobile showroom has visited country shows and market towns and the first tour commenced at Whitsun with the Warrington Horse Society's Show, proceeding afterwards through Lancashire and Yorkshire. Enquiries regarding the itinerary should be addressed to the Solid Smokeless Fuels Federation, 1 Grosvenor Place, London, S.W.1.

NEWS

New Gas Research Centre

The Gas Council has set up a second research centre at the Nechells Gasworks, Birmingham, the work of which will be mainly concerned with the complete gasification of coal. This centre will be administered by the West Midlands Gas Board on behalf of the Gas Council and its Director will be Dr. F. J. Dent, the present Assistant Director of the Gas Research Board.

Coalite Progress

The Directors' Report and Accounts (year ended March 31st, 1951) of Coalite and Chemical Products Ltd., makes encouraging reading for those who, for the sake of smoke abatement, have a special interest in the well-being and continued progress of the company that put low temperature carbonization fuel on the map and made "Coalite" a household word. It is particularly interesting to note the developments in the production of new and important chemical by-products—materials of value to the national economy produced from the coal volatiles that would otherwise be doing damage as smoke.

A new battery of retorts was put into operation in January and a further battery in course of construction will be ready to meet the winter demand for "Coalite." A dividend of 6 per cent. has been declared and £150,000 has been put into the general reserve.

Manufacturers' Resolution

We hope that the dwindling minority of industrialists and business men who cling to the belief that "where there's muck there's money" will have noted the excellently phrased resolution recently passed by the Executive Council of the National Union of Manufacturers. It ran thus:

"The National Union, having regard to the diminishing coal reserves and to the difficulty of maintaining an adequate working force in the mines, would strongly urge consideration of the question whether it would not be advisable to devote a considerable proportion of this capital expenditure to saving coal by its better and more economical use for both domestic and industrial purposes.

"The National Union is giving its full support to the fuel efficiency campaign which the Ministry of Fuel and Power is promoting among manufacturers, but it believes that further important steps should be fully explored, e.g., the electrification of railways and collieries, the full use of hydro-electric and tidal-electric power, and the general use of smokeless fuel for domestic and office heating."

Colliery Spoilbanks

The National Coal Board has pointed out to us that readers should not conclude, through a reading of the article in the last issue on "The Problem of Colliery Spoilbanks," that underground stowing of refuse might be a general solution to the problem of unsightly and burning spoilbanks. "Underground stowing at existing collieries," it is said, "is at present only done where the technical mining conditions make it essential to adopt this method. Its cost and the limitations imposed by the underground layout preclude its being extended to a very large number of collieries. Its adoption at Donisthorpe Colliery was entirely due to mining conditions and it is fortuitous only that some of the material is being obtained from an existing spoilbank."

The Natural Smokeless Fuels of South Wales

1. Introduction

THE user of anthracite and Welsh Dry Steam coals cannot have failed to observe how different these coals are, both in appearance and performance, from all other coals.

Anthracite is hard and lustrous, does not break easily, and does not soil the hands on touching. The most noticeable features in actual use are the virtual absence of smoke and soot and the relatively small amount of ash produced. Users of both these fuels will undoubtedly observe that flues and chimneys are not quickly fouled.

Anthracite and dry steam coals ignite more readily than most coke, but are more difficult to light than bituminous coal. On the other hand the fire, once established, will burn continuously and steadily and can be left unattended for longer periods than with any other solid fuel. The advantages held by anthracite and dry steam coals are readily recognized and it may be of some interest to explain how they are related to the physical and chemical properties of these natural smokeless fuels.

2. Occurrence of Anthracite and Dry Steams

Deposits of anthracite are to be found in many parts of the world, the most notable sources being South Wales, America, Russia and Indo-China. The properties of the anthracite found in these countries vary a good deal, the best being mined in South Wales. Although America produces substantial quantities of anthracite, it is significant that a strong demand for Welsh anthracite exists both in the United States and Canada despite the high cost of transporting the coal across the Atlantic. The

South Wales coalfield covers an area which is approximately 60 miles long (east to west) and about 20 miles wide (north to south). The main seams of coal run more or less continuously from one end to the other and they undergo a gradual change in character. In the north-west corner of the coalfield the coal produced is anthracite and as one moves in a south-easterly direction there is a gradual transition from anthracite, first to dry steam coal, then in turn, to semi-bituminous steam coals, coking coals, and finally to high volatile gas coals.

There has been much speculation as to the agencies which have been at work to account for the marked difference in the character of coal substance over the relatively short distance of 60 miles between the eastern and western boundaries of this coalfield. Undoubtedly, the principal factors have been pressure and heat, and the anthracite coals found in the west have been subjected to higher pressures and temperatures than the bituminous coals found at the eastern end of the field.

3. Composition of Coals

(a) *Volatile Matter*

All coals consist mainly of the two elements carbon and hydrogen which provide all the heat derived from the burning of coal. The hydrogen is combined with some of the carbon to form complex compounds called hydro-carbons or "volatile matter" which are expelled from the coal when the latter is heated. These volatile compounds are the principal cause of smoke when using bituminous coals in domestic appliances. Anthracite and dry steam coals burn with little or no smoke because they contain smaller quantities of volatile hydro-

carbons. For instance, anthracite contains from 5 per cent. to 10 per cent. volatile matter whereas some bituminous house coals may contain 40-45 per cent. The volatile content of dry steams is a little more than that of anthracite, i.e., 10 per cent. to 14 per cent., which again accounts for their smokeless character.

It is believed, in the case of anthracite and to a less degree in the case of dry steams, that the original volatile content of the vegetable matter from which all coal is derived has been virtually eliminated by the action of heat in the period during which the coal was being formed.

Table I shows the comparative carbon, hydrogen and volatile contents of anthracite, dry steam coal and bituminous house coal.

TABLE I

	<i>Anthracite</i>	<i>Dry Steam</i>	<i>Bituminous House Coal</i>
Carbon	92.0/94.5	91/93	80/87
Hydrogen	2.8/3.9	3.9/4.25	5.0/5.5
Volatile Matter..	4.5/9.5	10/14	35/45

It will be noted that anthracite and dry steam coals contain the greatest amount of carbon and the lowest amount of hydrogen, and that their volatile content is very low in comparison with other coals.

As explained previously, the change from anthracite to dry steam is very gradual and it will be found that some of the coals occurring in the top end of the anthracite group are similar in composition to the coals appearing in the lower end of the dry steam group. There is, therefore, a great similarity in the behaviour of some anthracite and dry steam coals. The slightly higher volatile content of the dry steam coals makes them more reactive than anthracite and they are in consequence more immediately susceptible to variations in draught and thus respond more readily to air damper control.

(b) *Ash Content*

The solid residue remaining after coal has been burned is derived from two sources. Part is derived from the mineral matter dispersed throughout the coal substance and is known as the

“Inherent Ash”, and the remainder from dirt which becomes mingled with the coal during mining operations, and is called “Extraneous Ash.” The combination of both is referred to as the “Total Ash.”

The incidence of ash is of the greatest importance to the domestic user since it directly affects the performance of the appliance and the frequency of fire attention.

In this respect Welsh coals are favoured in that the best anthracites have between 2 per cent. and 3 per cent. of ash and Welsh dry steam coals have 4 per cent. to 6 per cent. Thus a plant burning for 12 hours at the high rate of $2\frac{1}{2}$ to 3 lb. per hour accumulates at the end of the period a matter of only $\frac{3}{4}$ lb. of ash in the case of best anthracite.

The ash obtained from these coals is usually heavy in nature and tends to fall through the fire-bar spaces by its own weight. Furthermore, the radiation of heat from the firebed is not masked as it would be with a flocculent ash and the maximum heat transfer to the room or surrounding boiler waterway is thus maintained.

(c) *Sulphur*

The sulphur content of all South Wales smokeless fuels is low and rarely exceeds 1 per cent. Sulphur pollution of the atmosphere is thus of a low order.

(d) *Density*

The high bulk density of Welsh smokeless fuels is illustrated in Table II. Several important advantages arise from this. A greater weight of fuel can be placed on the firebed as compared with less dense fuels thus reducing the time taken in fire replenishment, and fires can be made to last for very long periods with the certainty that the appliance will be alight after overnight banking. In addition, the available coal storage can accommodate a greater weight of anthracite and dry steam, which is an important asset in modern dwellings in which storage facilities are often restricted.

TABLE II

Bulk Density of Smokeless Fuel

Fuel		Bulk Density	
		lb./cu. ft	Cu. ft./ton
Anthracite		48-50	45-47
Dry Steam Coal		45-47	48-50
Phurnacite Ovoids		48-50	45-47
Gas Coke		20-27	83-112
Hard Coke		29-31	72-78

4. Preparation for the Market

Anthracite in South Wales is mined in much the same way as all other coals, the main difference being that the coal is obtained from a relatively large number of small units. The majority of the pits take the form of drifts or slants driven in the coal seams from the surface. There are, however, a few cases in which deep shafts are used to get at the seams and future production will undoubtedly be centred on a very much reduced number of production points having large outputs. Such new pits would justify the installation of modern equipment both in the winning and preparation of the coal.

(a) Cleaning

When the coal reaches the surface, it is inevitably intermixed with incombustible material in the form of shale, etc., which has to be removed before despatch to the consumer. All methods of separating the dirt from the coal are based on the fact that the density of coal is lower than that of the extraneous incombustible material with which it is mixed. In most cases the uncleaned coal is placed in a large "tank" of water and the contents agitated by pulsations generated by compressed air. Alternatively, a swiftly flowing water current through the tank is sufficient. In both cases the clean and therefore lighter coal is raised to a level above the denser shale and is thus easily removed for further treatment. The shale is taken to a dump or disposed of otherwise. Certain coals, however, present more difficulty in separation since the coal particles are interstratified with bands of dirt, and in these circumstances a different technique is employed in that the specific gravity of the washery water is artificially increased by the addition of fine sand or other similar

material. The clean coal then floats on top, the interstratified material is suspended in the middle, and the stone sinks to the bottom.

The above cleaning operations are of supreme importance since the attraction of the modern domestic smokeless fuel appliance is continuous operation and relatively labour-free attention. The incidence of shale, or coal fractions interstratified with shale, results in the necessity for frequent fire-box cleaning and the re-lighting of the fire, thus defeating the objects for which the appliances are designed.

(b) Coal Sizing

Both anthracite and dry steam coals are meticulously sized after separation by means of mechanical screens. In the case of anthracite there are many fuel sizes to suit a large number of domestic and industrial purposes. The performance of the appliance is directly associated with size, the smaller sized fuel giving a more compact fire with higher combustion rates. There is an optimum fuel size, however, below which the firebed tends to become less responsive to air control. In this connection it is extremely important that the fuel bed is not unduly disturbed by unnecessary or too vigorous use of the poker or other ash removing devices, as over-agitation of the fire impairs the performance of the appliance and wastes fuel. Table III lists the normal domestic sizes together with the types of appliances in which they are used.

In addition to the above domestic usages, anthracite is extensively used for a number of industrial purposes, principally as follows :

Anthracite Large Coals (over 5 in.) Anthracite Cobbles (5 in. to 3 in.) are used for malting, hop-drying, horticultural heating and for lime-burning. Considerable quantities of the graded products, i.e., Peanuts, Beans, Peas and Grains are utilized in the manufacture of clean tar-free producer gas which is a popular fuel in a variety of industries and which is also the basis of many chemical processes for the manufacture of Carbon compounds.

TABLE III

Fuel				Approx. Size (inches)	Type of Appliance
Anthracite	Cobbles	..	..	5-2 $\frac{3}{4}$	Central Heating Boilers
"	French Nuts	..	..	3-2	Large Cooker, Central Heating Boilers
"	Stove Nuts	..	..	2-1 $\frac{1}{4}$	Openable Stoves, Open Fires.
"	Stovesse	..	..	1 $\frac{3}{8}$ - $\frac{3}{4}$	Openable Stoves, Open Fires Heat Storage Cookers.
"	Peanuts	..	..	1 $\frac{1}{4}$ - $\frac{5}{8}$	Small Domestic Boilers, Heat Storage Cookers
"	Beans	..	..	$\frac{3}{4}$ - $\frac{3}{8}$	Special Automatic Boilers and Cookers
"	Peas	..	..	$\frac{3}{8}$ - $\frac{3}{8}$	Special Automatic Boilers and Cookers
"	Grains	..	..	$\frac{3}{8}$ - $\frac{3}{8}$	Special Automatic Boilers and Cookers
Welsh Dry Steam	—Large Nuts	..	..	2 $\frac{1}{2}$ -1 $\frac{3}{4}$	Cookers and Domestic Boilers
Welsh Dry Steam	—Small Nuts	..	..	1 $\frac{3}{4}$ - $\frac{3}{4}$	Cookers and Domestic Boilers
Phurnacite	Ovoids	..	..	2-1 $\frac{1}{2}$ -1	Cookers (All types) Openable Stoves and Domestic Boilers

The bulk of the duff coal, material below $\frac{1}{4}$ in. in size, is supplied to electricity generating stations, steam-raising plants and briquetting works.

5. Phurnacite

This is a carbonized ovoid and special note should be made of the word "Carbonized" as there are many other ovoids marketed which are not so treated and are not smokeless in nature. Phurnacite is made from selected low ash Welsh dry steam coals. The coals are first ground in mills to a minute size and then mixed with a pitch binder in order to obtain coagulation. The mixture is then passed through a high pressure moulding mill where the ovoid is initially formed. The next step is the carbonizing process where the crude ovoids are slowly treated at medium temperatures, in inclined vertical chamber ovens, each being 8 in. wide. In this stage, the pitch binder and some of the original volatile of the coal is driven off thus ensuring that the finished product is smokeless. After leaving the ovens the ovoids are quenched and finally screened in order to remove any broken pieces before the fuel is despatched to the domestic market.

The carbonizing process provides a really hard ovoid, capable of withstanding very rough treatment in transit. The user can therefore be sure that his fuel is true to size and that no smalls or fines collect in the fuel store. In addition, during combustion the firebed has uniform air spaces which means that easy and effective control can be maintained by the air damper.

The Phurnacite ovoid is easily recognized by its unique shape and the two recessed rings encircling the ovoid. The ovoids are clean to handle.

6. Future Availability of Anthracite Dry Steam and Phurnacite

It cannot be anything but disappointing to those who, having incurred the expense of installing a modern appliance, find that the appropriate fuels are in short supply and that in consequence they have to use less satisfactory alternative fuel. This problem is well in the minds of the South Western Division of the National Coal Board, particularly as the Simon Report strongly stresses the necessity for an increased supply of domestic smokeless fuels. The partial exhaustion of the more easily worked coal seams, the man-power problem and the difficult geological conditions are, however, all factors which have to be dealt with in the endeavour to meet the ever-increasing public demand.

The problem to be solved is two-fold. There is the immediate problem of smokeless fuel shortage and this is gradually being overcome by improving the efficiency of the existing collieries, thereby gradually surmounting the difficulties of man-power. The second is long-term in that the whole of the coalfield is to be reorganized in order that the large available reserves can be developed.

In the "Plan for Coal" of October, 1950, a sum of £27 million is envisaged as capital expenditure on the anthracite field in the next 15 years. Four new anthracite deep-mines are en-

visaged, some of which will be located in the large reserves of first-grade fuel recently discovered by geological survey. In addition, other pits, where the coal seam promises longevity, will be reconstructed.

In the dry steam and bituminous area, a sum of £70 million is to be set aside, a considerable portion of which is for the pits producing dry steam coal for domestic purposes. Here again, some new pits are envisaged and a number of existing pits are being reorganized.

It will, of course, be appreciated that

the national call for maximum foreign trade must inevitably affect the availability of smokeless fuels for the home market, particularly so in the case of anthracite which has to be shipped to Canada and elsewhere to maintain essential markets.

In regard to Phurnacite, an extension to the existing plant is now ready to come into commission. This will result in increasing the availability of Phurnacite from 150,000 tons per annum to nearly 300,000 tons per annum, which addition will considerably assist the domestic user.

Smoke Prevention Abstracts

173. Establishment of a Smokeless Zone. Hendry, T. J. P. (Sanitarian, May, 1951, 59, 274-7). Reviews the procedure and position in respect of a central smokeless zone planned for Rochdale, and discusses the working of the relevant provisions in the Rochdale Act, 1948. Of special interest is the definition of "smoke" contained in this Act, namely, that it includes "soot, ash, grit and gritty particles, but shall not include smoke emitted when coke, anthracite or any other fuel of a type specified by the Corporation is used in a furnace, stove or other appliance which is suitable for burning such fuel and is properly maintained and used."

174. The Pimlico Scheme. Margolis, A. E. (Munic. Eng., June 8th, 1951; paper presented at an R.San. Inst. meeting). The adoption of district heating on a nation-wide scale will, it is claimed, solve the problem of sanitation of the air in urban areas, and considerably improve the hygienic condition of housing. The saving of great quantities of coal creates a sound economic basis for district heating with heat-electric generation. This method has been adopted for the Pimlico scheme, which incorporates a large-capacity, hot-water accumulator

for balancing the heat and electricity loads. The heat supply will be extended to Dolphin Square and the new housing estate in Warwick Way. When completed about 3,200 dwellings, with a population of about 11,000, and a number of communal buildings will be supplied with exhaust heat from the Battersea power station, for spaced heating and hot tap water, and altogether about 11,000 tons of coal will be saved annually.

175. Oxidation of Air Pollutants. McCabe, L. C. (Ind. & Eng. Chem., U.S.A., April, 1951). Describes recent work and conclusions of Haagen-Smit of the California Inst. of Technology on the formation of substances injurious to plants and damaging to the eyes (an effect noted particularly in California) by the oxidation of organic materials mostly hydrocarbons polluting the air. Oxidation is by ozone, the action of oxygen and sunlight, and by the catalytic action of the nitrogen dioxide and nitrogen oxide cycle releasing atomic oxygen under the influence of sunlight. These oxidations produce peroxides, aldehydes, and acids, and aerosols are formed which decrease visibility and would be a source of eye irritation. For a total picture of the air pollution

problem the presence of inorganic materials cannot be neglected. Such a contribution we find in the sulphur dioxide which through its oxidation with sunlight and oxygen will decrease the visibility.

176. Citizen Co-operation in Pollution Survey (Chem. & Eng. News, U.S.A.). First phase of a two-year test on various forms of atmospheric contaminants is under way in Cleveland with 125 householders initially helping the city's air pollution control division. Cedar panels are being hung on residences, will be examined monthly by city lab. technicians. Panels are painted with various composition paints and hold a steel disc, piece of silver, and glass microscopic slide. Paints and attachments will measure economic damage resulting from different types of air pollution in various sections of the city. Titanium pigment paint will react to acid gases

from chemical and fertilizer plants. Lead base sample will be affected by sulphur gases. Glass slide will detect flouride gases. Steel and silver samples will record corrosion and tarnishing from sulphur compounds.

177. Pollution Control. Various authors (Chemical Engineering, New York, May, 1951). A special report dealing with control of water and of air pollution. In addition to an introductory article dealing with both fields under the title "Pollution Control—an Industry Must," by Nord, Melvin, there is a series of seven articles on air pollution, covering the following aspects: Pollutants, by Silverman, L.; Stack Dispersal, by Sittenfield, M.; Filtration, by Vedder, W. O.; Collectors, Scrubbers, by Lapple, C. E.; Precipitators, by Sproull, W. T.; Sonic Agglomeration, by Kiddoo, Gordon; and Odour Absorption, by Turk, A. and Bownes, K. A.

The New Alkali, &c., Works Report

87th Annual Report on Alkali, etc., Works : Proceedings for the Year 1950
By the Chief Inspectors. pp. 56, H.M. Stationery Office, 1s. 9d. net.

This new report is, as usual, a source of much important and interesting information for those concerned with air pollution. It shows how much attention is now being given to a wide range of "unregistered" processes, in addition to those that are registered under the Act.

In the report for England and Wales Mr. W. A. Damon, the Chief Inspector, gives an account of his visit to the U.S.A., from which we may quote a most useful summary of the main features of the normal type of ordinance to be found in that country, as follows:

"In the U.S.A. there is no Federal legislation on atmospheric pollution. Each city, county or state may make

such regulations as seem appropriate to its particular conditions. Most of the ordinances, however, are based on a common pattern and include regulations as follows:

(1) Dense smoke emission from either industrial or domestic premises is prohibited.

(2) Dense smoke is defined in relation to the Ringelmann scale (usually of a density equal or greater than No. 2 Ringelmann).

(3) Some relaxation is allowed in the case of certain special industries, locomotives, tugboats, etc., or when building up or re-making fires.

(4) The sale, transportation or use of solid fuel other than smokeless fuel is prohibited unless it is to be burned in a mechanically operated plant of approved design.

(5) Smokeless solid fuel is defined in relation to its volatile matter content

(usually not more than 23 per cent.).

(6) Building of new furnace installations or reconstruction of existing furnaces is subject to prior approval of the plans by the Smoke Commissioner.

(7) New or reconstructed furnaces must not be operated without an operating permit having been secured.

(8) Emission of fly ash in concentration greater than 0.8 lb. per 1,000 lb. of waste fuel gas is prohibited.

(9) Appeals against decisions of the Smoke Commissioner may be lodged with an Appeal Board.

"Details differ from city to city, but the above is the rough outline of a typical ordinance. Effective administration obviously requires a large staff of inspecting officers and thus entails substantial costs but I received the impression that smoke-consciousness is increasing in the U.S.A. and that attempts to deal with smoke have the support of both ratepayers and industrialists. The 'prior approval' regulations (see (6) and (7) above) amount to the setting up and acceptance of standards relating to flue and stack dimensions, furnace settings, instrumentation, etc. It is considered essential that plans and specifications submitted for approval should be examined promptly by competent and qualified officers and that a reliable and impartial appeal board should be available."

Spoilbanks

The position with regard to burning colliery spoilbanks shows a small improvement and satisfactory co-operation between the Alkali Inspectors and officials of the National Coal Board is noted. It is said that "the wisdom of providing pipes in a spoilbank by means of which internal temperatures can be systematically taken and recorded has been amply demonstrated. In several cases, treatment applied promptly to areas in which an abnormal rise of temperature was noted has resulted in control being quickly established."

Generating Stations

A number of visits have been paid

to electricity generating stations, and in this connection the Inspectors report that power stations in Great Britain consume annually about 30 million tons of coal, and at the present moment the rate of consumption is increasing. In spite of the continual expansion that is taking place, the extent of grit emission should automatically decrease because the greatest quantity arises from the older and more inefficient stations. The use of these will be progressively reduced as new plants become available, and they will be closed altogether when the installation of new plant has caught up with requirements. There is a direct financial incentive to achieve this as soon as possible because fuel costs at the older stations are much in excess of those at the modern stations.

At the Battersea Power Station 70 per cent. of the waste gases are now being washed for the removal of sulphur dioxide. After a certain amount of trouble during the early part of 1950 improvements in the washing system and additional filtering capacity were made, and the removal of the sulphur dioxide is now more uniform and satisfactory.

Cement Works

Because of the constant demand, it is stated, cement works have been operating to full capacity throughout the year. Progressive installation and reconstruction of dust arrestment plant has continued, but, although there are now over a score of electrical precipitators in the Thames-side works some cause for complaint is likely to persist in this area of very intensive production.

DONORA SEQUEL

Lawsuits arising out of the Donora smog disaster were settled out of court by American Steel and Wire—apparently for \$235,000. Involved were about 130 actions asking for damages of \$4.6 million. (See *SMOKELESS AIR*, Spring, 1950, No. 73, for accounts of the Federal Report on the smoke fog in 1948 that caused the deaths of 22 persons and the illness of nearly six thousand).



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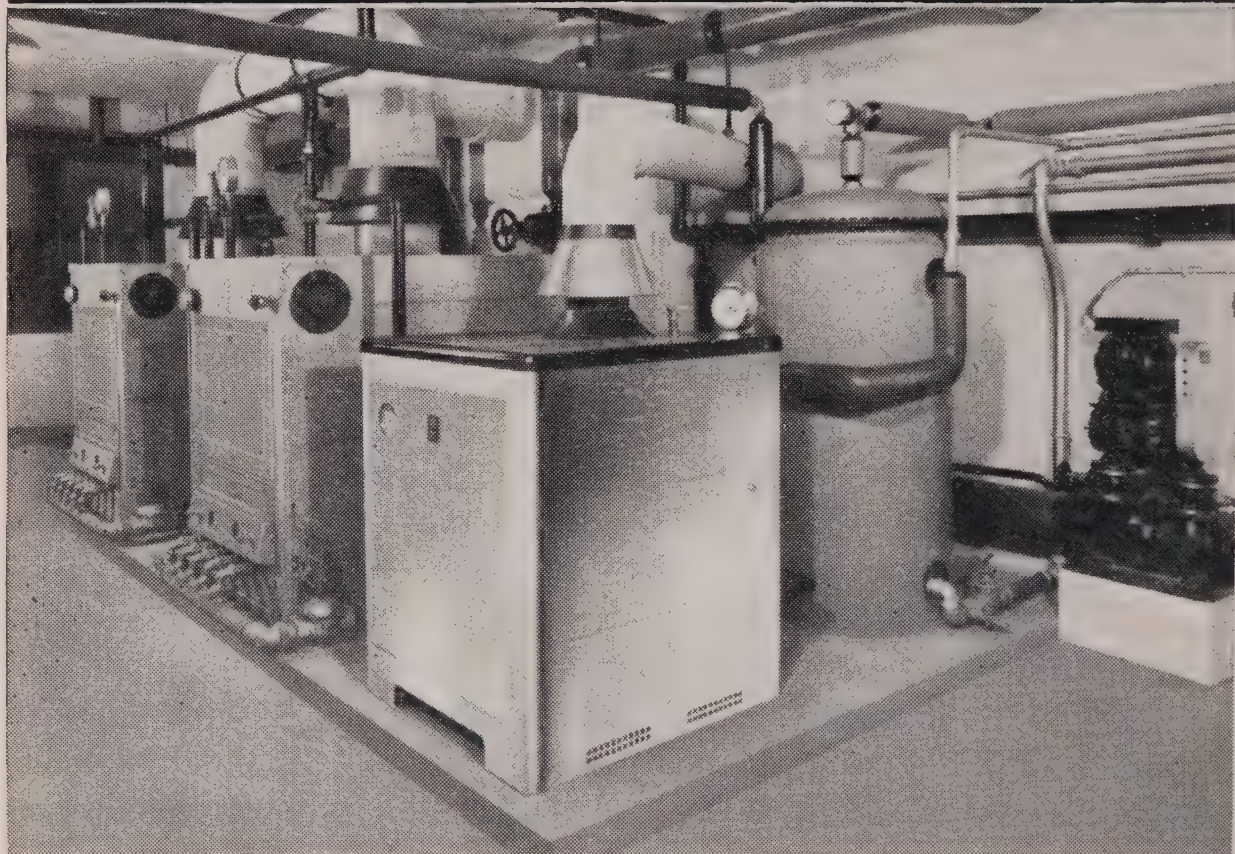
The Radiation system may be installed with either a solid fuel appliance which burns, without smoke, any solid fuel *including bituminous coal*, or as a fully automatic gas unit. Architects, housing authorities and others—especially those interested in smoke abatement—should write for literature explaining the system in full, or visit the experimental houses at Stanmore where both solid fuel and gas installations may be seen in action. But please apply first for an appointment to Radiation Group Sales Limited, Lancelot Works, Wembley, Middlesex. Telephone: Wembley 6221.



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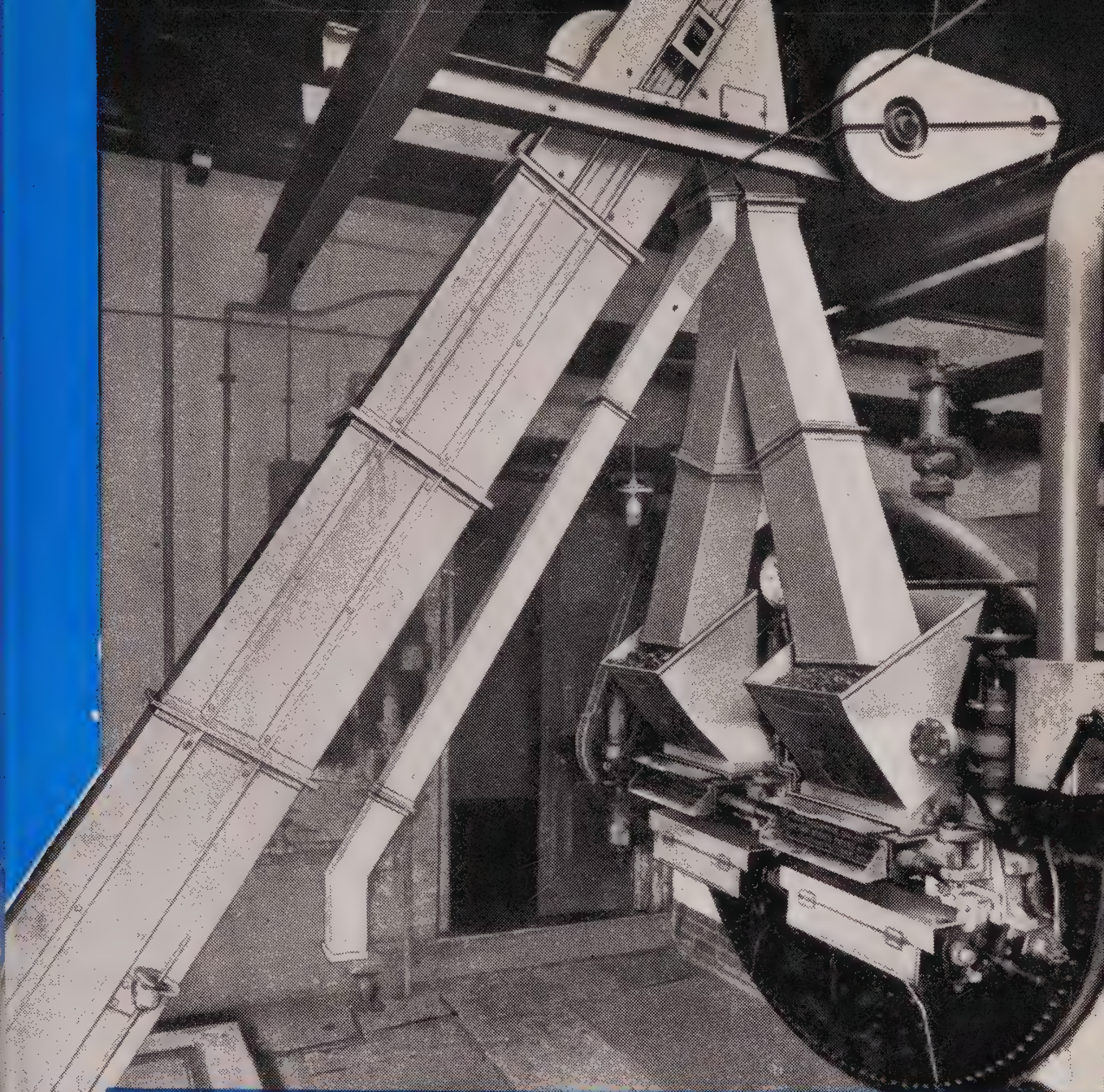
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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL



No. 80

WINTER

1951

ONE SHILLING

In this Issue

Power and Waste in their Social Setting
Blackpool Conference

How the Conference Brings Publicity

The Fuel and Power Gap

Salford's Smokeless Zones Inquiry

Hard Coke

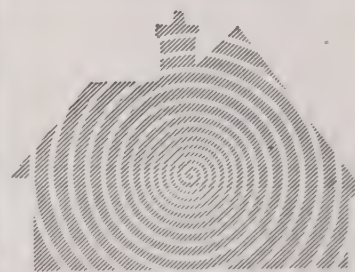
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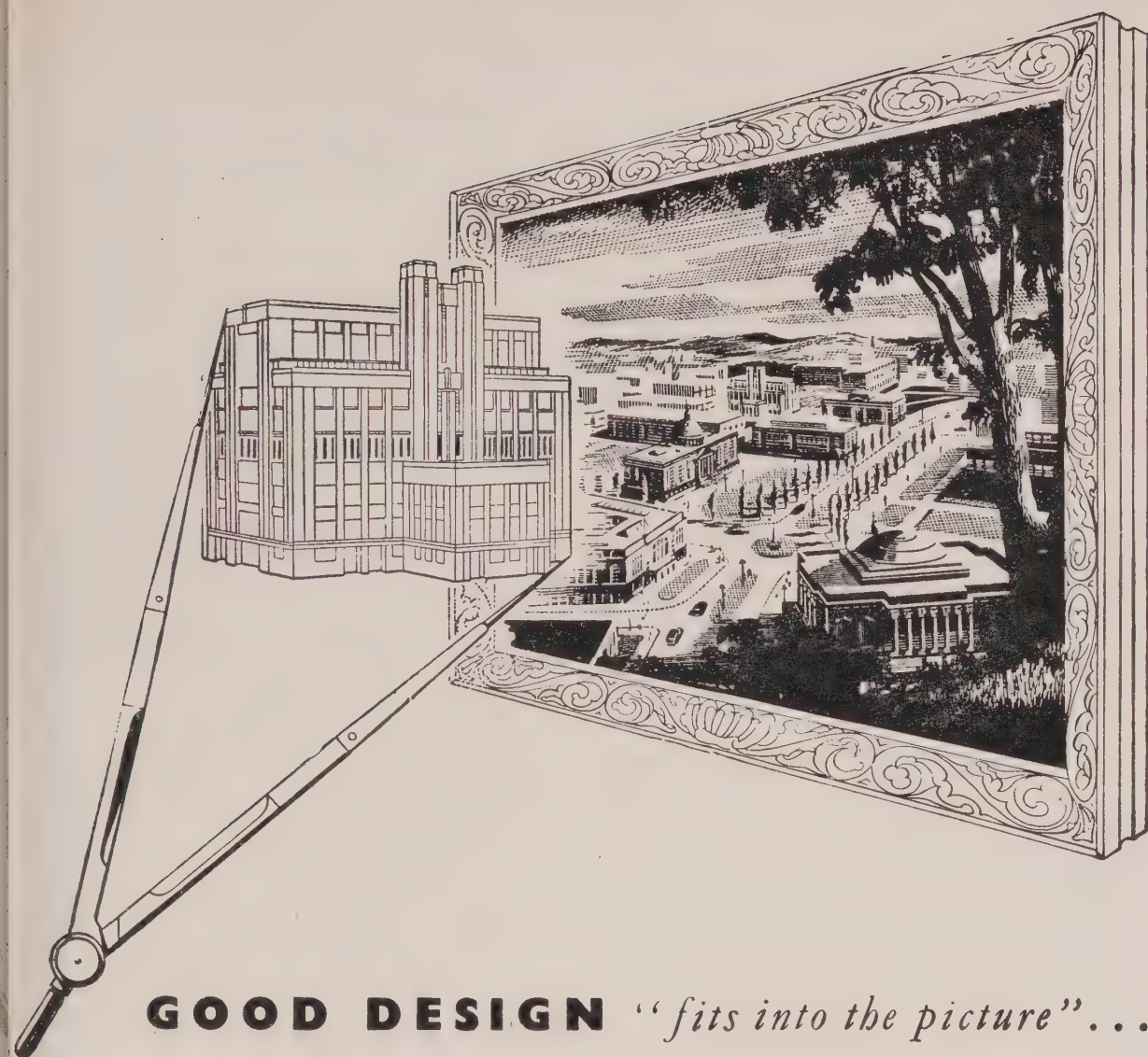
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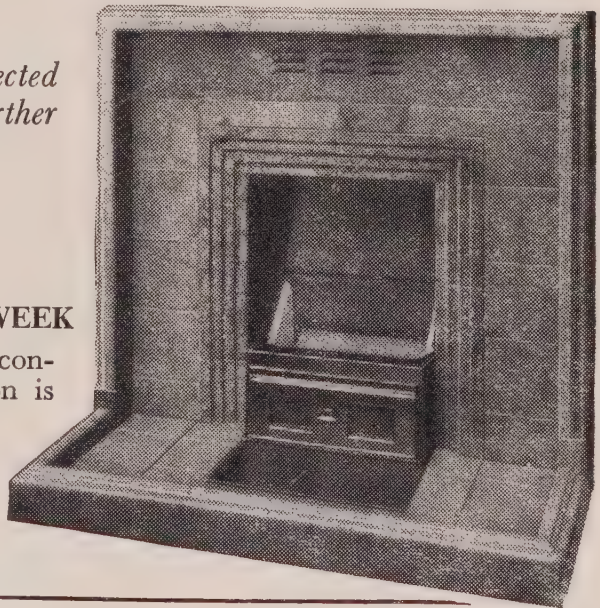
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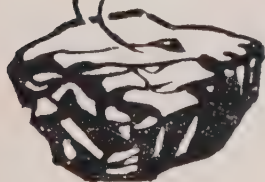
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SMOKELESS AIR

Vol. XXII. No. 80 Winter, 1951

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The Vision



of John Evelyn



JOHN EVELYN. Born 1620. Died 1706. From original etching by Robert Nanteuil reproduced by courtesy of the National Portrait Gallery

There was very little in life which the aristocratic John Evelyn did not find interesting. His Diary proves that he was typical of his age and class, versatile, and with an unflagging curiosity. A classical scholar, he was also a founder member of the Royal Society.

Among his diverse accomplishments were the study of chemistry, the writing of books on many subjects, whilst his advice was sought in planning gardens and compiling libraries.

A Royalist, he became the confidante of King Charles II to whom, in 1661, he presented his well known "Fumifugium: or the inconvenience of the aer and smoak of London dissipated together with some remedies", one of which was the planting of sweet smelling trees in London to purify the air.

Even today, nearly 300 years later, what he described as the "hellish and dismal cloude of sea coale" is still very much in evidence, but can now be readily dispelled by the application of the "Oldbury" Chain grate stoker which ensures efficient and absolutely smokeless combustion with high output from a wide range of fuels.

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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air*

SMOKELESS AIR

Taking Stock

THE annual conference always seems to mark the end, and the beginning, of the Society's year, and is thus an occasion for taking stock. At Blackpool it was heartening to see so full a programme of papers, every one of which demanded close attention, received and digested so keenly and with so much appreciation. The feel, or mood of the Blackpool conference was, to those who have been in the movement for a long time (and there are many) both encouraging for the Society and of promise for the future. One of the important points about so successful an event is that, despite the fact that progress must of necessity be gradual,

and despite the fact that the Society can do only so small a fraction of what it is straining at the leash to do, it so well demonstrates the firm moral support that is so essential to any movement. It would be easy for members to become dispirited and to grow impatient—and yet it is only their continued backing that enables the Society to go on, doggedly and yet always more hopefully.

It is perhaps all a matter of confidence based on a correct understanding of the problem and an acceptance of the inevitable need for patience and for the waging, not of any *blitzkrieg*, but of an untiring war of attrition along the whole of the air pollution front. How not to succeed has been demonstrated only too often

by campaigns—not usually in this country—that have started with great outbursts of enthusiasm and wonderful publicity, and which because of lack of sustaining force, have quickly flopped most miserably.

Possibly at the hub of the Society's many activities we may tend to become too nervous about our problems. Especially do we see, and dare not forget, the ever-present financial anxieties and all the frustrations that arise from them. We tend to expect members to feel similarly frustrated, or at least impatient that we should start to do this or that, or pursue or develop something else more effectively or energetically. The gratifying and encouraging thing is that, by and large, members see the situation as we hope they may, and understand the Society's difficulties as well as they appreciate its achievements.

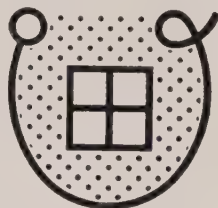
Coke for Industry?

The question has been put to us whether it is good policy for authorities using prior approval powers to insist on coke-burning steam-raising plant and to forbid or discourage coal-burning appliances, even when they are of the modern automatic and virtually smokeless types discussed at the recent conference. It is a matter on which the Society has made no official statement, but one factor alone seems to decide the issue. This is that more coke is essential for any substantial progress in the prevention of domestic smoke, especially for smokeless zones, and that there is insufficient for our needs and will be insufficient for many years to come. As Dame Vera Laughton Mathews suggested in her Presidential Address at Blackpool, it is indeed desirable to divert coke from industrial to household use. Smoke abatement in the home can come only by the use of smokeless fuels, whereas in industry it can be attained with bituminous coal in modern appliances. To insist on coke for industry is therefore to perpetuate the domestic smoke problem. It may be that from a perfectionist viewpoint these appliances are not

ideal, but the practical result of insisting on coke must be more smoke rather than less.

AP & SPA

This intriguing device is the new emblem of our friends the Air Pollution and Smoke Prevention Association of America. From the first number of their new journal *Air Repair* it seems that it was chosen only after a study of more than



2,000 alchemical characters found in a rare volume at Mellon Institute. The outer loop symbolizes purification, and the "window" in the centre is one of the symbols of air. The dots signify dust, ashes and other particles—by extension, air contaminants. The second issue of the Association's new quarterly, *Air Repair*, contains much we should like to quote. It reports a "Cleaner Air" week held during October, an event in which Cincinnati seems to have played the leading part. One interesting publicity idea was the open-air display of a mannequin model, named Cinder Ella, in a clean white dress. At the end of each day the dress was removed and chemically tested for the dirt and grime collected. A similar model, displayed in Times Square, New York, is reported to have collected 7,000 million particles in a day—but the report does not say what size they were.

By Any Other Name?

The letter on another page, from a member who wishes the Society to change its name, re-opens a question that has been discussed before in these pages. The curious may like to turn up the Winter-Spring issue of 1942 (No. 48) and read the article "The End of Smoke Abatement?" and the correspondence that followed. It has also been considered by the Executive Council and was a point in a questionnaire sent to members. There is however, no reason why it should not be argued once more, especially as

few members, we think, would say that our present name is ideal. The trouble has always been to find an alternative that everyone approved. There is objection to the narrowness of "Smoke," and the weakness of "Abatement," but against this there is the familiarity of the phrase "smoke abatement." The main reason for not changing, in fact, appears to be the same as that which keeps the title

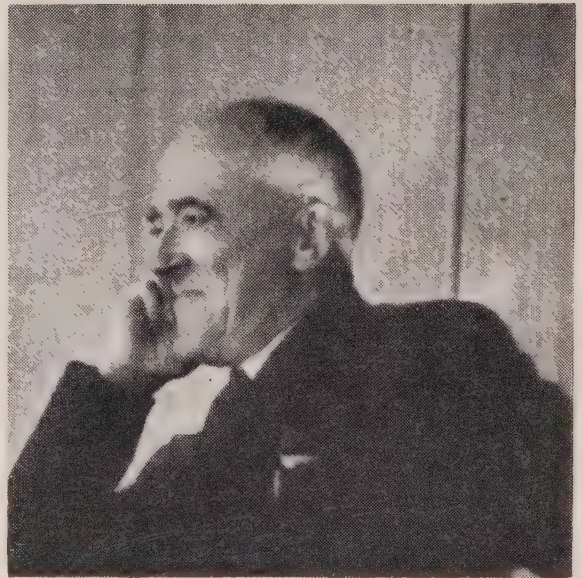
of the *Fortnightly* in being many years after the review became a monthly.

But if the Society ever does change its name we hope that for administrative and publicity purposes the new one will be short, sweet, and simple. To judge from a caption in their journal, our American friends, mentioned above, already seem to be regretting that their new name is such a mouthful.

F. E. Tylecote

The Society's New President

To say that a man is well-known or esteemed in his profession, or in the circles in which his interests and activities lie, is a popular way of introducing or beginning to write about him. The difficulty with our new President, Alderman Professor F. E. Tylecote, J.P., M.D., D.P.H., F.R.C.P. (Lond.) is to know which of many circles to mention first. Professionally, he is a distinguished physician, and was Professor of Medicine (now Emeritus Professor) at the University of Manchester, as well as having a consulting practice in the city. Next, as an Alderman of the Manchester City Council, he is prominent in the municipal world and is Chairman of the Health Committee of the Association of Municipal Corporations. Then he has a close interest in the arts and has for many years been Governor and member of the Council of the Whitworth Art Galleries in Manchester. He has been a member of the Executive Council of the N.S.A.S. since the new constitution was adopted, and was Chairman of our North West Divisional Council from 1947 until this year. He is also a member of the Central Midwives Board, has been President of the Manchester Royal Institution, and was recently elected a Freeman of the Worshipful Society of Apothecaries and of the City of London.



Alderman Tylecote was born at Cannock in Staffordshire, but it may have been observed that he is rather closely associated with the place from which so many good smoke abatement people come—Manchester. His qualifications for the Presidency thus seem to be as complete as they could possibly be.

When he has some spare time, the President tells us, he likes to go to Cornwall to a fisherman's cottage he has converted at St. Ives, or to collect old glass and first editions. And another personal note that will help members to understand and appreciate their new President all the more is that one of his habits, or perhaps principles, is never to drive when he can walk.

Power and Waste in their Social Setting

by J. Bronowski

Conference Papers are normally recorded in full only in the volume of Proceedings, but as Dr. Bronowski's lecture has created so much interest it is reprinted here for the benefit of all members and readers.

I OUGHT not to begin what I am going to say without first thanking the Society for asking me to give this lecture. No doubt this is a usual beginning ; but I do not therefore make it perfunctorily. I thank the Society for having asked me to give this lecture because it gives me the occasion to speak about something which has been much on my mind. That subject, I will be frank with you, by no means stops at smoke ; indeed you will have noticed that I have adroitly scratched the word "smoke" from my title. My subject has grown in my mind from thoughts which began at smoke. But it has grown to become for me, in the last years, a wider problem and a graver presence. For my subject is the future of this country.

Smoke is a thing which we make for ourselves ; nobody helps us to make it, not even fate. We make it of course by the way we burn our coal, which means by the way we do our work and our living. There are therefore two ways to end the nuisance of smoke. One is to give up this industrial work and life, and turn to something else : something simpler and greener. The other is to hold to our industrial life and to get rid of the smoke as something which has no business there : not a part of industry or even of city life, but a blemish on them.

Living by Industry

I should tell you at once that my sympathy lies wholly with the second of these two cures. I like the country, and I am happy when I or anyone else can work where there are trees up the road and a stream under the hill. But the trees and the stream do not mask the fact that you and I and every man-jack in Britain, fifty million of us, live by industry. When we reach down, our roots strike iron : the baker and the village postman, the tinsmith and the carpenter, the collier and the analyst, and yes, the farmhand too. We are a country built upon a bottom of industry ; and to

withdraw from industry is, as a people, to give up our life.

All this is patent, and it would not be worth saying if it were not, for that reason, so easily shrugged out of the argument. We in this hall are all against smoke ; and we are against dirt and rickets and boiler-maker's deafness. I hope that we are against every evil in which industry has a part ; but do not let us therefore be persuaded that we are against industry. There are those who see in smoke only the symbol of industry, and whose attack on one is an attack on the whole basis of our life these last two hundred years. They would like somehow to turn us into a farming country, and to see London all fields again. I must make it clear that I am not of their party and I hope you are not. There are farming countries today and there should be ; but Britain cannot be one. I should not like to see her waste herself. I should like to see London green, but I should not like to see it all fields again. I should not even like to see Sheffield all fields.

The fact is that I am proud of London and Sheffield. They are not handsome cities, and I should like to make them so. But I do not therefore want to plough them up and sow them with clover. Our aim is to make a better thing of industry ; but it is not to destroy it ; not even to belittle it. There have been many blots on industry : child-labour and intolerable hours and dusts and poisons and lock-outs. Some are now wiped clean and some remain : factory dirt, back-to-backs, squalor and decay. We should be ashamed of these, and more, we should make others ashamed. But industry itself is nothing to be ashamed of. I think that industry is the pride and the history of Britain.

An Early Industrial Revolution

Let me make no bones about this at all. When the Elizabethans sailed out into the Atlantic, industry was already the staple they carried and the muscle to their



"The Elizabethan Age was our first industrial revolution"—merchant shipping in the Thames

Picture Post Library

adventure. Their ships were not paid for with corn but with cloth ; and when they made themselves great with common land, the crop they grew was wool. The gentlemen of Cornwall were not all sailors; some of them were busy in the adventure of mining. The Elizabethan Age was our first industrial revolution, and this deserves better than to be forgotten in the glow from breakfast beer and piracy. London grew rich enough to build the theatre Shakespeare wrote for, not by farming but by trade in her manufactures. These were goods for which the Bristol merchants bargained in the Tolzey and paid on the Nails there.

But I do not need to skirmish with any romantic about the details of Elizabethan coke and glass making. I can step forward a hundred years to another age restless with imagination and movement : the age when John Evelyn persuaded Charles II to give his name to the new Royal Society, much as he persuaded him to look at the work of an unknown carver called Grinling Gibbons. And in the society where Christopher Wren jostled with Newton, and the poet Dryden with Robert Hooke, what were the problems

which great men thought worthy of their excited study ? They were navigation and metallurgy, gunnery and dye-stuffs, and my own interests which I am proud to trace back to that age—mining and statistics. Newton himself spent thirty years at the Mint, always active and always practical ; and showed by his example how highly his age rated the arts of commerce and of industry.

I want to come still closer to our day. Step forward another hundred years ; we are at 1760 and the Industrial Revolution. It began hard and bleak ; but Blake and Wordsworth were born at that moment, and England doubled her people in seventy years, and put them into leather shoes and clean iron beds and gave them white bread. I am tired of having the Industrial Revolution maligned as if it had put out the sun. Our health and our vigour and the delight in action which is still our pride were made then ; and the men who made them were not money-grubbers, they were great men and I am angry when I hear them slighted. Joseph Priestley and Baskerville and Arkwright, Wedgwood and Watt and their friend John Wilkinson, William Small who

taught Jefferson and Count Rumford who hated him—they are the match of any generation that walked the earth with its head high. They built the foundations of the great industries we live by, and I am not in the least ashamed of their work.

Men Make History

You will notice that I have spoken of the growth of industry not in terms of process and turnover, but in terms of men. My reason is that those men were much less muddled than history has been. In the 150 years since Matthew Boulton died, Birmingham has swept round and over the neat factory which he took to Soho because work there was orderly and spacious. Etruria is now as dark as the rest of the Potteries, from whose squalid cottage industry Wedgwood moved deliberately. These men were more clear-sighted than those who came after them. They knew that the things they were trying to do, precision work and glazing china and the fine processes of industry, are not a grimy hugger-mugger and do not thrive in it. To them from the outset dirt and crowding were forms of waste, and they would have liked to scrawl over them as one of them did over other pieces of bad workmanship, "This won't do for Jos. Wedgwood."

They were the pioneers of efficient industry ; but it is not an accident that these Midland men were also liberal humanists, and much suspected of admiring the French Revolution. The fact is that they were single-minded men ; to them waste was waste, whether it was waste of materials or of human skill. They did not draw a line between factory problems and human problems ; and one reason was that they brought to them both a single method—the method of research. They had faith in science, and many of them were remarkable scientists, in the Birmingham Lunar Society and the Manchester Philosophical Society and later in Yorkshire. And it was part of that faith, which Adam Smith underlined in *The Wealth of Nations*, that industry will not do well unless it is run well. When William Murdock put out the torches in the Soho factory and invented gas light for it, when Benjamin Franklin wrote to Boulton that the right thing to do with smoke is to burn it, they did not pause to admire themselves as laurelled benefactors of mankind ; and neither did they think of themselves as gluttons for efficiency. They thought of themselves

modestly as scientists, and it seemed to them plain that a sensible solution of a problem of light or heat or output must of itself be efficient and dignified to get her

Practical Values are Human Values

I said at the beginning that my subject was the future of industry, and here I have been talking of nothing but its past. But do not be misled ; what I have been talking about is not dead ; for it is the very marrow of every civilization—the belief that its most practical values are also human values. This belief, I insist, was strong in the men who founded our industries. And it was not something which they put on on Sundays. It underlay their thought because their thought was scientific and took all problems in its stride. This is what made them succeed, the assurance that the way to handle a problem is to think right through it, all of a piece ; and we owe our world to it.

That world has not stopped growing since 1760, but in this century it has begun to grow very skew for us. It has been discouraging to see the chemistry of Roebuck and Perkins drift to Germany, the looms go to Japan, the furnaces to Lorraine, and all the steel and metal work of the Midlands go to the United States. We have suffered the fate of all good teachers, that our pupils have turned out very bright. In our plight, we find ourselves advised by two kinds of Jeremiahs. One advises us to go back to the land, and points out owlily that this would cure the nuisance of smoke by the way. I have already said what I think of this solution, and I will keep my temper and say no more.

The other prophets of despair propose (of course) the opposite. We are now behind in the industrial race, they say, and therefore we cannot afford to do anything but stumble on ; we must not, as it were, stop even to tie our shoe laces. We cannot afford to clean and tidy our works and, what is as important, our processes. We are far too poor, they say, to modernize our plant, or to invest our talent in new research. Let us just sweat along with what stately Edwardian equipment we have ; and when it does at last fall to pieces (though they made it pretty indestructible) why, we can always buy the latest machine from the Germans or the Americans.

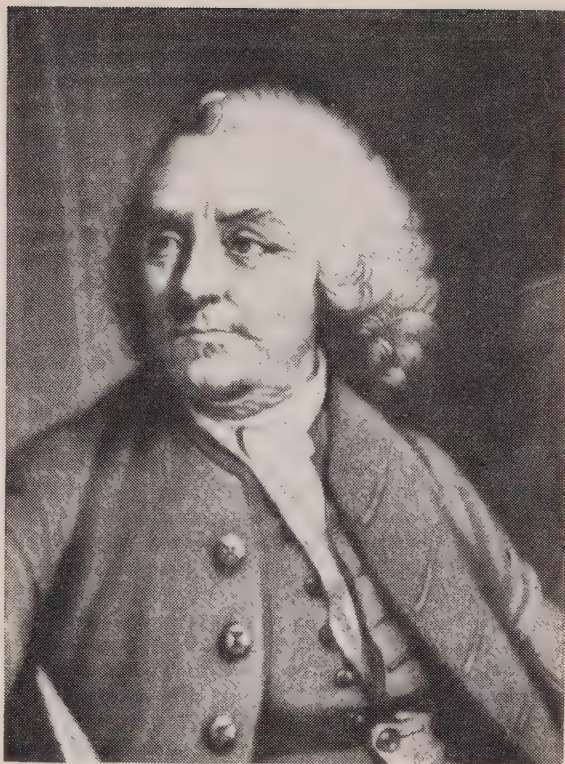
Method Not Technique

The essence of this—what shall I call it ? I do not like to dignify it by calling it an argument, and I must call it some-

thing. The essence of this nonsense is, that it supposes that what we taught others was simply a technique. Those who speak like this think that our success, in spinning or smelting or making dyes, depended each time on some trick of the trade ; and now others have filched these secrets from us. But this is quite mistaken. What we taught others was method, what we taught them was efficiency and attack, and the techniques are only a by-product of these. Believe me, where the industries of our rivals are ahead of us, it is not because we have taught them to use our techniques, but because we have taught them something more important, to strive for better techniques. We were the pioneers who showed that invention and efficiency will master any problem ; we taught them and, yes, we were willing to learn them too, from Huguenots and French royalist and German liberal refugees. And now that our success has spread to the corners of the world, are we asked to unlearn the lesson ? Are we really going to be content to snort along in an elderly way in the rear of the field, and protest that we have not the time to change our style or our spikes ?

This country has a number of endearing and a number of maddening habits. I count among both a certain strain of Emmet and Heath Robinson, which inclines us to treat any elderly piece of equipment much like a pensioned gun-dog whom it would be disgraceful to grudge feed and house-room. I hope that we shall always be able to afford the dog, but I will not hear a word in favour of antediluvian machines ; and least of all do they seem to me lovable because they smoke as fiercely as their owners. The owner may not afford a new machine ; the nation cannot afford the old one.

I am speaking here to the small owner as urgently as to the large—yes, and to the smallest of all, the house owner. For he has a piece of equipment on which he dotes, which is most prodigal of energy and health. I mean, of course, the old-fashioned grate, which as a machine for burning coal was out of date before Benjamin Franklin died in 1790. About that time, William Blake wrote two poems about the child chimney sweeps, which will move me to passion and compassion. Poor climbing boys, their sooty and cancerous trade has not made us much wiser. Our grates still puff out so much benzpyrene that it could give every laboratory white mouse in the country cancer. We still darken the sun with



Benjamin Franklin, who wrote to Boulton that "the right thing to do with smoke is to burn it"

(Picture Post Library)

smoke, and then choke the etiolated plants. And we still waste our national income each year, which is as much as we have recently spent on building new houses.

I am in no doubt at all that this country can hold its place among the leaders of world industry. But not by blowing 16 or 17 cwt. of the energy in every ton of coal up the flue ; and not by scattering sulphur on the wind and begging an allocation in Washington. We talk grandly of harnessing the tides on the Severn at a cost of £100 millions ; but half that sum would modernize enough house and factory grates to save 20 million tons of coal a year. And there would still be quite a margin left for the next generation to save.

John Evelyn fumed against the sulphur in the air 300 years ago, because it withers life. A hundred years later, Roebuck and Keir built our chemical industry on sulphuric acid. Since then the use of sulphuric acid has become as precise a measure of a nation's strength as the figures of horse power or real income. In the last fifty years, world use of the acid has risen sevenfold. What do we do ? We complain that we are short of sulphuric acid for our needs, which do not quite reach 2 million tons a year. Yet every year we blow up our chimneys in this country enough sulphur to make at

least 7 million tons of acid—four times our own needs, and more than a quarter of the needs of the whole world.

Modernizing Our Industries

For us in this country, and indeed in Europe, the task of modernizing our industries is critical ; and you must let me dwell on it for a few minutes. I have insisted that we are an industrial country. We do not have the resources of North America ; but this does not mean to me that we do not have their industrial potential. It is their agricultural sufficiency which we lack. We can and we must match their industrial strength.

How shall we hope to do this ? By looking ahead, and foreseeing now that the materials of industry are changing. They are changing in two ways. First, the treatment is becoming more important than the raw material. We have been using aluminium in aircraft since before the first war. But at that time, the yield point of aluminium alloys was five tons per square inch ; today it is thirty-five tons. The aircraft industry has flourished on technical improvements like this. I can summarize their importance by recalling that the first planes that flew carried 15 lbs. of engine for every horse power they developed. Even before we invented the jet, our native skill in metallurgy and design had cut this down to 1 lb. per horse power. Of course a very British form of sport, called outwitting the Treasury, had already prompted us to do the same thing for the motor car engine years ago.

But there is a second and deeper change in the materials of industry. The familiar raw materials are becoming scarce. Zinc and copper, rubber and wool—once they were indispensable, but now we wonder whether we must long go on paying famine prices for them. Why ? We know enough chemistry to build up for ourselves molecules which have almost any property we need. The basic industries must in fact more and more turn to the task of taking these custom-built molecules out of the laboratory and manufacturing them for industry. We are doing this for alloys and already for a great range of polymers, which include fibres and plastics and drugs. But here I think we have not taken a bold enough lead ; for example, we have left the pioneer work in polymers to the oil chemists, and have neglected our own great resource of coal as a basic chemical. Why, if the oil industry had not had the itch for research, it would still be using

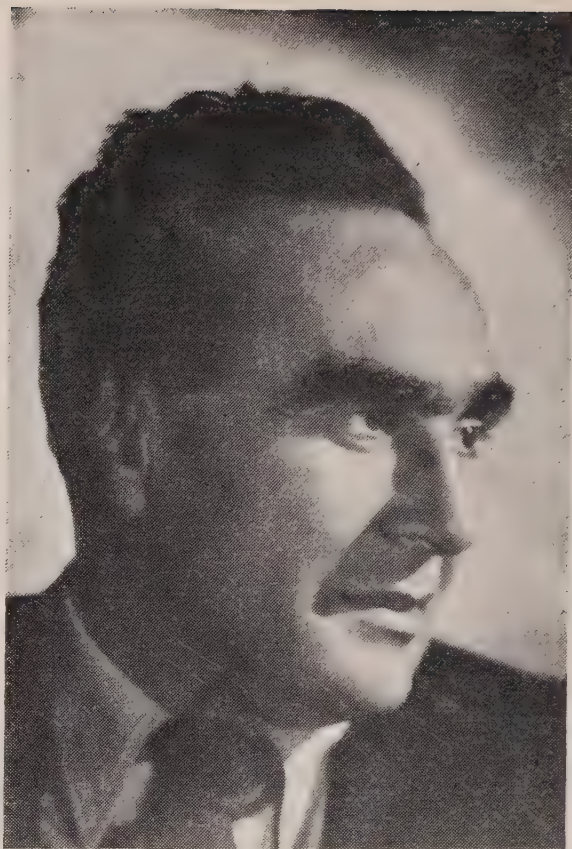


Photo : John Vickers

Dr. J. Bronowski

its product as Rockefeller did—to burn in kerosene lamps.

You will see that the burden of the changes which I foresee is this, that they shift the source of national wealth from raw materials to skill. Very well ; we are strong in industrial skill ; but is not something else also needed to treat and to make the new materials ? The answer is yes, indeed ; the new materials will have to be made at a much higher cost in energy than once went into the winning of zinc or rubber.

Energy Sources and Needs

We seem to have reached an odd paradox. We have long been warned of the fearful day when the world resources of energy would run out : oil in tens of years and coal in hundreds. Now I am saying that raw materials are really the scarcer ; and that in any case this country can only live by lavishing its resources of energy on the making of new materials and on their treatment in new light industries. Have then the prophets been wrong in forecasting a famine of energy ?

They have certainly been wrong about the world's energy. Our use of coal and even of oil is by no means running away with the earth's stock. Our use of water power is only a few per cent. of that

resource, which in Europe alone offers us 75 million horse power ; and this is a renewable resource. And behind these stand a dozen more remote but wholly practical sources of energy, if ever we run short enough to need them. They include the heat of the earth, which has long been used by power engineers in volcanic Tuscany ; and differences of temperature in coastal waters, which are about to be tried in French West Africa. They include wind and tides, the growing of sugar cane for industrial alcohol, and even the flooding of the North African deserts to grow algae in the brackish water. No, the world is not likely to run out of energy, so long as it has man's inventiveness at its command.

But what of the energy needs of Great Britain ? They set us both a harder and a more pressing problem ; and we shall certainly need atomic energy to solve it on the grand scale to which I want our new industries to aspire. I hope that we shall have an experimental power station running on plutonium, as we plan to do, within ten years ; and a massive use of atomic fuels within twenty-five.

But do not therefore suppose that there is nothing for us to do meanwhile, or that our native sources of energy have no part to play. I should not be talking to you this afternoon, and my thoughts would not have begun at the waste in smoke, if I had nothing more urgent to say. We have a great head of energy here, now, waiting to be tapped ; and to make the new industrial revival I have preached, we must learn to use it at once. It is the wealth of energy which we waste, day in and day out. It is the 20 cwts. of energy that is there, ideally, in every ton of coal—and the 17 of these ideal cwts. which we throw away. It is the smoke up the chimney and the soot on the boiler, the steam that goes to waste in the cooling towers and the smell round the gas works, and a million inefficient appliances in every factory and home.

Machines which Think

Let me give you one example, how the new industries of Britain will have to make the most of our resources of power. It is the machine which thinks—at least, it does what its operator calls thinking. That is, it switches itself on and (more important) off, and adjusts itself to its load. This is not a distant fancy—we have begun to use these machines, and we must use them if we are to make the most of our energy and our materials. I will quote what I have written elsewhere,

because it puts both the method and the lesson succinctly :

“ One means which new factories will come to use is the automatic control of their own processes. We find it easier still to have energy leaking from every belt and flywheel than to turn a dozen switches on and off in a sequence of operations. Machines to us are still all thumbs and muscle ; we are not at home with the thinking machine. But in fact, the machine which reads its own gauges and throws its own switches is as great a saver of mechanical energy as is the human brain ; and we shall have it with us soon, to stay.

There is a moral in this likeness. The primitive processes of nature are also lavish in their waste of energy ; for example, the action of leaf chlorophyll in making sugar from the air, on which all life depends, uses only one per cent. of the sunlight on the leaf. But as the living material becomes more highly organized it also becomes more sparing ; until the muscle is a far more efficient user of energy than any machine. The brain does not show so obvious a return of work for the energy put into it as does the muscle. Yet the human system has found that it pays to supply each cell in the brain with about three times as much energy as the other body cells. Indeed, the body invests a quarter of all the energy it gets in the brain. The best use of energy is in planning its use.”

The lesson is worth recalling when we make plans for the future of our industries.

The Energy We Waste

Let me now summarize what I think about this future. In doing so, I hope that you will not grudge me a word of repetition here and there ; for the subject is near my heart, and I do not think I exaggerate its importance to us all. I think, and I have said, that the largest store of energy which this country possesses is the energy it wastes. Here the cure is modernized plant, the revision of layout and sequences in all industrial operations and, above all, new processes. And for these, we have a source as rich as the energy we throw away ; the skill of ten generations of men bred to industry. It is I think on this that our future rests, on the craftsmanship of the fitter and the electrician and the mill-hand ; for I cannot believe that any country is poor which has these ready to put to new uses. And I do not fear the rivalry of any nation if we give ourselves the chance to

match them in invention.

What is the general shape of the industries towards which we should therefore move? Plainly, they should depend more on technical skill than on raw materials. Raw coal and iron were once our staples, but now their day for us is past, as surely as the earlier days of wool. And we should not forget that we ourselves made the Industrial Revolution out of cotton, which we did not grow. So today we must learn the lesson that we taught to the Swiss, and turn to industries which hinge on skill. There are such industries ready for us, just over the horizon: in alloys and aircraft and other light construction, in chemicals and antibiotics, in the range of new materials built atom by atom to do special jobs, and in the use of coal itself as a chemical.

And we have one advantage over the Swiss. We were after all making watches in Clerkenwell on the factory system before they were a nation, two hundred and fifty years ago. We have a longer tradition of these crafts and, above all, we have an unequalled tradition in science. The Royal Society was already respectable when the Clerkenwell clocks were new. Ever since then we have gone on doing superb work in the laboratory: Cavendish and Joseph Black, Priestley and Humphry Davy, Faraday and Clerk Maxwell, J. J. Thomson and Rutherford—the list is endless, and I have not even glanced at the biologists and the doctors and the geologists and how many more.

From Laboratory to Factory

I am naturally prejudiced in the place which I give to our scientific tradition and to the potential of discovery which it carries. But whether you go all the way with me, or only part way, do not neglect this rich source of industrial strength which lies under our hands. In the five years since the war we have won the Nobel prize for physics three times, for chemistry once, and our three discoverers of penicillin have won the prize for medicine. I could add that a British mathematical philosopher has won the prize for literature, and a medical pioneer in nutrition has won the Nobel peace prize. But it is already a record without equal in any five years; and it leaves no doubt that, at the laboratory bench, we have all the genius that we shall need.

Can we translate it from the laboratory to the factory? There, let us confess it, lies our weakness. We are short of the technologists who are expert in making science practical. Indeed, we are not

always sure what a technologist is, and we go on thinking that he can be trained in a technical school with men who are learning a much simpler skill in one industry. The step from the glassware on the bench to the full scale plant, the transition through the pilot plant, which is the special province of the technologist, that we have yet to learn. We have to learn it today in one field most of all: the field of atomic energy. J. J. Thomson and Rutherford created that, and more than most nations we shall want to turn ten years from now towards the massive power in a small space which it can yield. We, the discoverers, can command it if we bring to its problems the fundamental science and the skill in technology which together are the brain and the nerves of a modern nation.

I warned you that I should wander from smoke, and I have done so. But in doing this I hope that I have shown you that the problem of smoke fits squarely into the larger problem of our industrial future which should be troubling us. Smoke is a nuisance, and every discovery man makes sets him at the same time a nuisance problem. In twenty years we shall have the nuisance of atomic wastes, and I hope that we shall have sturdy and indignant pioneers to combat them. But smoke is also more than a nuisance; it is a symbol of the untapped resources which we have ready to hand, in the waste of power, of materials, of industrial skill and scientific discovery. I believe that our life as a great nation depends on reaching down into these resources. If we put an end to the waste of them all at once, you and I may think our task well done. And we shall be just in time to turn ourselves into the National Society for the Abatement of Atomic Wastes.

Yorkshire Regional Committee

The annual meeting of the West Riding of Yorkshire Regional Smoke Abatement Committee was held in Leeds on July 4th. An annual report was submitted and approved, and Dr. I. G. Davies was re-elected Hon. Secretary. An address was given by Dr. Roe, of the Department of Social and Industrial Medicine of Sheffield University, on investigations being made as to whether sulphur in the atmosphere is a greater cause of bronchial pneumonia than soot and dust.

The Blackpool Conference

THERE was another upwards swing in attendance at the eighteenth annual conference of the Society at Blackpool in September, with a total of 428 members and delegates. There was as usual, a full programme for the three days, when the only respite from the meetings were afternoon visits to the Marton gasworks, just outside the town, and to the Ribble generating stations at Preston.

A feature of the programme was that thirteen authors contributed papers to three sessions, with the Presidential Address—Dame Vera Laughton Mathews's retiring address—and the Des Voeux lecture by Dr. Bronowski on the opening day as the only "solo" events. Summaries of Dame Vera's address and the sessional papers are given below, while the Des Voeux lecture has created so much attention that—not being too long for this journal—it is reprinted in full.

There had been a little fear that the programme was rather too technical for many of those attending, especially the sessions on small steam-raising plant and the policies of the major industries. This fear however proved to be quite unfounded and the papers and discussions in these sessions were listened to with real attention and appreciation: a tribute to the excellent way in which the papers were introduced by the authors and the high, well-informed and practical level of the subsequent discussions.

There were two social events—the delightful civic reception when we were the guests of the Mayor of Blackpool (Councillor Joseph Hill) and our own intimate "evening party" at the Savoy Hotel on the following night. (We wish we had a photograph of some of our more dignified members spiritedly engaged in the game of winding little wooden racehorses across the floor on a string twisted round a pencil held behind the legs,

and with trousers compulsorily hitched up to the knee!).

The *Proceedings* of the conference, now in course of preparation, will contain all the Papers and discussions in full and any fully-subscribing member may obtain a copy on early application. For extra copies, and to non-members, the price is 7s. 6d., or 7s. 8d. by post.

As mentioned in the article about the publicity given to the conference, the following accounts of the papers are as they were issued to the Press. They do not pretend therefore to be abstracts in the usual technical sense.

The Presidential Address

In her retiring Presidential Address at the opening of the Conference, Dame Vera Laughton Mathews discussed the smokeless fuels position. She pointed out that although the modern types of open grates and stoves, now being fitted in new houses, gave savings with any kind of fuel, they were much more efficient with coke than with bituminous coal. But only one-quarter to one-fifth of the coke produced was available for domestic purposes.

"The domestic market at present has the last call on supplies. Looking to the future it would appear that it should have the first, in order that the recommendations of the Simon Report in regard to space heating by smokeless solid fuel may be implemented." "This recommendation of the Simon Report," continued Dame Vera, "would be greatly helped if the National Coal Board would adopt a policy of supplying coal at a cheaper rate to the carbonizing industries which produce smokeless fuel, and making those domestic consumers who insist on burning coal in the raw state pay extra for their hobby."

Looking to the future Dame Vera said that she would like to feel that "within my own lifetime I might hear a future President congratulating some great city or some whole county—possibly Lancashire—on having declared its final smokeless zone so that one could drive, or fly, for miles without seeing any smoke. At the same conference one might perhaps hear the British Railways being



Welcome to Blackpool

Left to right : Ald. Professor F. E. Tylecote (incoming President), Councillor J. Hill (Mayor of Blackpool), Arnold Marsh (General Secretary), Dame Vera Laughton Mathews (retiring President), S. N. Duguid (Chairman, Executive Council)

praised for having completed their electrification programme, or the National Coal Board for having made its last colliery smokeless."

"When the evil of air pollution is overcome, public opinion will doubtless be amazed that their forbears were content to live in a country where nearly 2½ million tons of dirt and soot were discharged yearly into the atmosphere, to be inhaled into the lungs, to ruin our architecture and to make greatly increased labour. When a reform has once been accepted, the previous evil always seems incredible to future generations."

The Smoke Problem of Small Steam Plant

A smoke problem that is of concern to every town in the country—the smoke from small works, central heating plant, hospitals, laundries and the like—was discussed at the annual conference of the National Smoke Abatement Society in Blackpool today. Five short papers, arranged for the Society by the Combustion Engineering Association, were read by technical experts. The authors dealt with hand-fired boilers, three different types of mechanical stoker, and the detection of smoke with the photo-electric cell or "magic eye." The chairman was the Chief Inspector of Alkali etc., Works, of the Ministry of Local Government and Planning, Mr. W. A. Damon.

In the first paper, on hand-firing, Mr. V. R. Chadwick described how coal

should be fired in order to ensure the burning of the volatile matter that pours off immediately and may give rise to smoke. Mr. C. H. G. Hayward outlined the development of chain-grate mechanical stokers, the earliest of which he said dated as far back as 1841. First developed for large water-tube boilers, chain-grates have now been designed for small shell boilers and have proved very successful in burning low-grade fuels. In one case, following the installation of a chain-grate stoker the cost of fuel fell from £45 to £33 a week—a cheaper fuel did the work, and less of it was needed.

Coking and sprinkling stokers were described by Mr. H. E. Pearsall. The former, by using moving firebars, shuffles the fuel along the firebed, while the latter sprinkles it as and when required by means of an automatically controlled spring-loaded shovel, or by revolving paddles. The fire can be kept continuously bright, so that the volatiles from the frequent small amounts of fresh coal can readily burn.

In the underfeed stoker, which was explained by Mr. C. C. Day, the coal is introduced upwards into the furnace, from below the fire, so that the volatile gases had to pass through the red fire as they are evolved.

Smoke can be emitted even with these mechanical stokers, if they are not correctly controlled. Immediate information about whether smoke is being formed is therefore necessary, so that adjustments

may be made at once, and how this can be done with photo-electric cell devices was described by Mr. G. A. G. Ive in the last paper of the series. A beam of light passes across the flue to a photo-electric cell that is connected with a smoke indicating meter. If the strength of the light beam diminishes because of smoke in the flue a pointer in the meter moves round to show the actual density of the smoke. The apparatus can be so set that an alarm—such as a Klaxon horn—sounds if the smoke exceeds a chosen limit.

Industries' Efforts for Cleaner Air

Representatives of five of the country's biggest industries spoke this morning at the National Smoke Abatement Society's conference in Blackpool on the policies that were being adopted for the progressive elimination of air pollution. The collieries, gas, electricity, iron and steel, and cement manufacture were the industries so surveyed.

At the Collieries

For the National Coal Board Mr. N. Higginson described an actual installation recently completed at one colliery. He pointed out that the Board operates about 4,000 Lancashire boilers, of which all but about 500 are hand fired. Growing coal output and mechanisation had increased the demand for power at the collieries and they were finding it difficult to supply enough steam from existing boilers. The long-term policy was electrification, which would take years to implement, and in the meantime the board was making efforts to modernize existing plant. As an example of what is being done all over the country Mr. Higginson gave a detailed account of modernization at a colliery in the Midlands. Chain grate stokers had been installed and other improvements made. As a result smoke nuisance had been cured, steam pressure was more reliable, and savings in fuel and manpower were nearly £10,000 a year, or 4½d. per ton of coal produced from the mine.

In the Gas Industry

Mr. J. W. Denton, for the Gas Council, said that the future policy of the industry was for large efficient stations sited at focal points where they could best meet domestic and industrial demand for gas and coke. Such modern gas works would not detract from the amenities of the district, and in fact the abolition of small works and the carbonization of coal in larger and more efficient units would contribute to smoke abatement without any nuisance being created in the vicinity

of the new stations.

As an example of what can be done, Mr. Denton described the gas works at Torquay, which are situated on the shore of the bay, with a residential area around them. The works had therefore been designed to fit in with the surroundings and trees and shrubs had been planted in and around them—even adjacent to the sulphur removal installations. Ten possible sources of smoke, grit and dust had been studied, and Mr. Denton described the precautions taken throughout the works. Measurements of dust and sulphur, and of the lime content of the soil in and around the works showed how effective the various measures had been. They cost about two per cent. of the total capital involved, and cost no more to operate than the less effective sweeping brush.

Electricity Generation

Dr. H. E. Crossley, of the British Electricity Authority, surveyed three forms of air pollution for which power stations may be responsible and outlined the policy of the B.E.A. with respect to each. The first—that of water droplets from cooling towers, causing a mist in the vicinity of the stations—has recently been solved as a result of research in the Authority's laboratories. The interiors of



Oui, Français, votre patrie est belle,
Et chez vous le soleil étincelle!
Mais l'on n'a pas chez vous
Ces deux objets si doux,
Le Pôqueur, et la Côte-escoutelle!"

The 1878 "Punch" cartoon and limerick mentioned by Dame Vera Laughton Mathews in her Presidential Address. (By permission of the Proprietors of "Punch")



A group of Conference delegates at the Marton Gasworks, Blackpool

the towers were to be modified with a system of louvres that trap the water droplets before they can pass into the atmosphere.

On sulphur gases Dr. Crossley described the cost and the difficulties inseparable from gas-washing systems such as that at Battersea and the now discontinued process at Fulham. The Authority, he said, believed that effective dispersal of the gases could be attained by high chimneys.

Grit emission was a problem that had often given rise to local nuisances in older power stations that had never had any satisfactory means of removing it from the chimney gases. The newer stations were all equipped with efficient grit arresters and design was constantly being improved. The Authority was spending an average of £4,000,000 a year on measures to prevent air pollution.

Iron and Steel

Mr. Neil H. Turner, for the British Iron and Steel Federation, agreed in his paper that iron and steel works had been in the past, and to some extent still were, great culprits in regard to smoke and dust emission. The complexity of the problem was made clear by the different causes of pollution discussed by Mr. Turner—iron making in blast furnaces, coke making in coke ovens, steel making, steel rolling, steam generation, and finally from steam locomotives and cranes in the works. The overall picture was one of considerable difficulties and of gradual progress being made through attention to many details.

Cement Manufacture

The final paper in this session was given by Mr. E. Burke, nominated by the Cement Makers' Federation, who in reviewing the problems of the industry pointed out that little or no smoke was emitted during the processes, but that the dust that caused complaint was from the raw material tumbling about in the rotating kiln and passing into the atmosphere with the combustion gases. Much of the dust was arrested by curtains of chains at the end of the kiln, and the remainder was most effectively removed by electrostatic precipitators.

Smokeless Homes

The closing session of the National Smoke Abatement Society's Conference at Blackpool this afternoon was on the problem of domestic smoke—from the woman's viewpoint. Papers were read by Mrs. Elspet Fraser-Stephen, General Secretary of the Women's Advisory Council on Solid Fuel, Miss Marjorie Lovell Burgess of the Gas Council, and Dame Caroline Haslett, Director of the Electrical Association for Women.

Mrs. Fraser-Stephen asked housewives to consider what they could do, here and now, during this autumn of 1951, to further smoke prevention and save fuel. She urged them to look at their fireplaces and if they contained old-fashioned basket or stool grates, to do away with them immediately and put in either an improved type of fire or an openable stove. Then she can feel, continued Mrs. Fraser-Stephen, "that she personally has not only taken an active and useful step

towards lightening her own labour, reducing fuel costs, and increasing the comfort of her home, but has also helped to make her own city or town cleaner, to the benefit of herself and her neighbours."

Miss Lovell Burgess stressed the fact that the gas industry produced two smokeless fuels from coal—"the one industry whose engineers deliberately set out to make smoke, from good quality coal, for the sheer value of what that smoke contained." She urged the joint use of gas and coke in the home: "Gas and coke together—gas for speedy cooking, auxiliary heating, and the provision of instantaneous hot water, winter and summer, and coke for a more even, and

cleaner, distribution of heat in the home—form a natural, economical and hygienic smokeless fuel partnership.

Dame Caroline Haslett emphasized the great contribution to the cleanliness of our homes and towns made by electricity. In use electricity made no smoke or dirt, and although the generating stations burned over 16 per cent. of the nation's coal they produced less than one-half per cent of the smoke omitted. "The individual housewife," said Dame Caroline, "is very much at the mercy of the community in which she lives in regard to smoke nuisance, but in her own home she can go a long way towards alleviating the deteriorating effects on furnishings and fabrics by the use of electricity."

How the Conference Brings Publicity

EVERY movement depending on public opinion likes to be given publicity in the Press, and the N.S.A.S. is naturally no exception. Indeed, because we cannot afford so many other forms of publicity we have always had to look to the Press for making smoke abatement more widely known and understood, and we may say how grateful we are for the hearing we have been given over many years. It is not easy to make an objective judgment on success or failure in this field of our work, but it has been gratifying on more than one occasion to observe the surprise (and even envy) of publicity-minded people outside the movement. The Publicity Manager of one conference town, for instance, said that he had had more press cuttings relating to our conference (and mentioning the town) than for any other conference ever held there.

This could not happen, of course, if the newspapers did not regard smoke abatement, or some features of it, as of news interest. It is no use at all

trying to obtain publicity through the Press unless, in the opinion of editors, you are saying or doing something that will interest their particular groups of readers. To have material of news value is thus the first essential, but after that much depends on the way the material is supplied. Newspaper men lead a busy life and they have far more matter than they can use, especially in these days of small papers, so that, other things being equal, a "story" that has to be dug out of a mass of unwanted material will not be given the welcome or the attention afforded to something that is, so to speak, ready to serve.

Members may be interested, as an example of what the Society does in its Press relations, in knowing what was done to secure Press interest in the recent Blackpool conference. First, early in September, was a special "local" story to all the provincial newspapers covering towns or districts from which delegates had been appointed by their local authorities. This began with an individually typed

line to the effect that "Councillor X and Mr. Y. have been appointed to represent by Z Borough Council" at the conference, and went on to give a general account of the programme.

Next came an invitation to attend the conference, with another advance story about speakers and papers, etc., which was sent to all the national newspapers, the principal provincials, and the trade and technical periodicals. This account began by saying; "National fuel problems, from the standpoint of the coal that is wasted in the form of smoke, will be the background of the three day annual conference of the National Smoke Abatement Society that opens in Blackpool on September 26th. Over 400 members and delegates from local authorities, technical bodies, Government departments, and the fuel and power industries are already listed as attending."

Finally, the printed papers themselves were circularized, accompanied by a summary of each paper in such a form that all or just one or two paragraphs of each could be used. (We have made use of most of these ourselves in the conference review on another page).

All this takes up a substantial amount of staff time during the period in which the completion of conference arrangements are in full swing, but it is the one and only way of enlarging the conference audience from the 400 or so who attend to the many millions who can read about it, and so it must be looked upon as a task of first importance.

The Results

We think readers will agree that this is so when they note the results obtained, in terms of the reports that have been published—or rather in terms of the cuttings we have received, for even the best of the agencies is reckoned to be not more than 75 per cent. efficient. The material available for the Blackpool conference was not as "newsy" as it could have been, and there was no visit from a Minister or anything at all sensational or pro-



"I'VE GIVEN UP SMOKING -
IN THE NATIONAL INTEREST"

Conference comment by "Vicky" in the
"News Chronicle"

(By permission of the Artist and Editor)

vocative. So Blackpool cannot claim to have broken any records as far as number of reports are concerned, though in space and usefulness they were excellent.

The figures may speak for themselves :

Pre-conference :

Newspaper	..	..	119
Periodical	..	..	18

During and after conference :

Provincial papers	..	..	150
National dailies	..	..	11
Periodicals	..	..	45

Total	..	..	343
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Leading articles and other editorial comment were published in the following papers: *Manchester Guardian*, *News Chronicle*, *West Lancs. Evening Gazette*, *Halifax Daily Courier*, *Nottingham Guardian*, *Bolton Evening News*, *Belfast News Letter*, *Electrical Times*, *Architect and Building News*, *Ashton-under-Lyne Reporter* series, *Mechanical World*, *Manchester City News*, *South Yorkshire and Rotherham Advertiser*, *World's Paper Trade Review* and *Gas Journal*.

It is amusing to see the variety of headlines of the snappier sort that crop up in such a bundle of cuttings. "They Want Less Smoke," "Smoke is Their Enemy" and "Civic Head for Anti-Smoke Conference" are of the

kind found among the advance reports, and "Smoke Abatement Debatement" may have aroused some puzzled interest. "Dame Vera Looks to Smokeless Era" was perhaps the prize won by the Presidential Address. "Maddening Habits of the British People" was the *News Chronicle's* four-column headline on Dr. Bronowski's lecture. "£4 Millions Yearly to Avoid Smoke" was a popular lead for Dr. Crossley's electricity paper, and Mr. Denton got support from his home town paper with "Conference told of Torquay's Happy Gas Works."

Mention must be made of the help given by the Press Association, which sends out its own stories on the conference, and through its representative at the meetings gets discussion contributions reported in the speakers' own local papers. Thus we get reports "South Yorkshire industries criticized by smoke expert," in the *Yorkshire Post*, reporting Mr. Law; "How to Save Coal—by Hove Fuel

Expert" in the *Sussex Daily News* on Mr. Fox; and "Walsall expert says women can play big part on fuel problem," about Mr. Stansbury in the *Wolverhampton Express and Star*.

We will conclude these notes by quoting from an appreciative and encouraging leading article in the *Gas Journal*:

When power cuts are no more, when gas fires are cheaper to install, and when coke supplies are reliable and of a guaranteed quality—then only will the dreams of Dame Vera, Dr. Bronowski, and all the other smoke abaters come true. In the meantime the Society is doing excellent work and spreading the gospel in a thousand different ways; and by the variety of its speakers at this latest conference (they came from the coal, gas, electricity, iron and steel, steam engineering, and cement industries), it shows that its approach is wide in scope and expert in quality.

The Society's Name

*To the Editor,
Smokeless Air.*

Sir,—At the Blackpool conference I was interested to find from talks which I had with some of the members of the Society that they thought the name "Smoke Abatement Society" was out-of-date, and should be altered to include all atmospheric pollution.

It will be noted that under section 110(1) of the Public Health Act, 1936, smoke is defined as "soot, ash, grit and gritty particles," but does not include dust not emitted from chimneys as an ingredient of smoke.

At the conference Dr. Bronowski mentioned that in the future we should probably have to deal with atomic wastes, and at the present moment many of us are experiencing the nuisance of pollution of the atmosphere from chemical works. Pollution from chemical works may mean a nuisance extending over large areas, and this has already happened where

a number of towns have been contiguous to each other.

I would suggest, therefore, that the time is now ripe for the Society to consider its title with a view to including all atmospheric pollution. I would also suggest as a basis for discussion that the Society be re-titled, "The Society for the Abatement of Atmospheric Pollution."

I may mention that the Society has already concerned itself with the emission of sulphur dioxide into the atmosphere from combustion, so that they have already extended their activities beyond smoke.

I should be glad to have the opinion of others with regard to these points.

Yours, etc.,

W. W. FOAKES,
Chief Sanitary Inspector.

West Bromwich.

(This letter is commented upon on page 56—Ed.).

THE FUEL AND POWER GAP

Industrialists' Conference in London

AN important and well-attended conference on "Meeting the Fuel and Power Shortage," arranged by the Combustion Engineering Association, was held in London on October 9th and 10th. Its purpose was to discuss, from an immediate and practical standpoint, the position as it is today, and what can be done to ward off what Mr. P. A. Sanders, President of the Association, in his opening remarks referred to as an impending catastrophe.

The first address was by the Minister of Fuel and Power, the Rt. Hon. Philip Noel-Baker, who was followed by Sir Hubert Houldsworth, Chairman of the National Coal Board. In the afternoon were papers on the supply and effective use of electricity and gas, and one by Sir Archibald Forbes, President of the Federation of British Industries. On the second day were papers on short term and long term economies, and finally on the requirements of a "National Fuel Policy." There were open discussions at each session, with many pertinent and searching questions.

The problem of smoke and its relation to fuel efficiency was mentioned only once—by the Minister—but time and time again it was evident that measures and principles being discussed must inevitably lead to less air pollution, either because they directly reduced coal consumption or because they would lead to its more efficient combustion.

One speaker in this discussion, it was interesting to note, made the proposal that industry should adopt "Codes of Practice" for their fuel-burning and power-producing installations—codes which would, the speaker thought, require some form of legal sanction behind them to make them fully effective. This, of course, is our own "Prior Approval" principle being advocated from another viewpoint, and is significant in

being—as far as we know—the first time that it has been suggested on purely fuel efficiency grounds.

Mr. Noel-Baker quoted the figure of 82 per cent. as the heat wasted from the fuel burned in this country, and pointed out that it was a problem of increasing demand rather than of diminishing production that had to be solved: coal consumption had increased from an average of 174 million tons a year in 1932-35 to 202 millions in 1950, and was now running at the rate of 210 millions. Sir Hubert Houldsworth stressed the fact that little further could be done to increase coal output at once, although he was more confident about long-term prospects. "Experiments are promising," he said, "and I feel we are indeed on the threshold of big developments in mining techniques and machinery."

Economy in Practice

Perhaps the most interesting session of all was that in which Mr. B. E. A. Vigers read a paper on "Short Term Economy," and Mr. Oliver Lyle one on "Long Term Economy." Sir Ernest Smith, who was in the Chair as Chairman of the Industrial Coal Consumers' Council, gave a keynote to the meeting with the remark that "industrialists, if they knew enough, could save all the coal necessary to see us through the winter."

Mr. Vigers's paper was one that should be read and digested by every director in every works in the country. It was packed with practical, informative suggestions and ideas. He said that the first step was to make fuel efficiency a prime interest of someone near board level, and then appoint—or train—a suitable person with executive authority to carry out the policy. His work would be both technical and psychological. The latter, mainly concerned with preventing waste, was the more

difficult. For example :

“ Departmental and process managers are primarily concerned with good production of a good product and they are often inclined to regard it as an unwarrantable interference if somebody else comes along to point out that they could get just as good results with less steam, gas or electricity, or even water, which nearly always represents consumption of power.”

The psychological factor also enters into the boilerhouse :

“ Boiler operatives must be trained how to do their job properly and well, but above all, their interest must be stimulated and they must be encouraged and persuaded to keep conditions at optimum at all times.”

In his own company, continued Mr. Vigers, they put the boilerhouse men on a weekly wage, staff basis, which he thought was preferable to bonuses. He mentioned a Canadian system that might be introduced over here : it is a condition of boiler insurance that the boilers shall only be operated by certificated men.

Solving a Grit Nuisance

It is often said that whereas measures to prevent smoke will save coal and money, there is no return of any kind for grit removal. Mr. Vigers, however, had a story which proved that even grit arresting can cut the coal bill :

“ I heard quite recently of a brewery company which had for many years operated a battery of Lancashire boilers without an economiser and with a very high exit gas temperature. They were also blowing out quite a lot of grit from the boiler stack. Eventually, they were compelled by local complaints to install dust collectors.

The exit temperature of the gases was so high that the dust plant would have had to have been made of special heat-resisting steel at very great cost, and they were eventually persuaded to install economisers as well, in order to reduce the temperature.

The result, of course, was that they made so much saving in their fuel bill that they had a handsome return on the capital cost of the whole installation, and what is perhaps more important, they released a substantial quantity of coal to be allocated to you and me.”

On the more technical side the speaker pointed out that except in special cases all the heat purchased in a factory is eventually thrown away. The first requirement was to see that it was not thrown away before it had done any good at all, and secondly, it should be made to do as much work, at different levels, as possible. To draw up a complete analysis of what happened to the heat was well worth while, and it was here that the mobile testing units of the Ministry of Fuel and Power were of great value. The possibilities of using heat more than once should be investigated, and the principle of this was put by Mr. Vigers thus : “ Heat, as well as being measureable in quantity, has a potential for doing useful work which is referred to as its temperature, and the simple rules which should be borne in mind are that heat should always be generated at the highest practicable temperature and rejected at the lowest practicable temperature. In its passage from its starting point to its finishing point, it should serve first those purposes for which a high temperature is essential and should then be passed on to other purposes where lower temperatures are adequate and, generally speaking, it may be said that the more stages through which it passes, the greater will be the economy attained.”

Mr. Oliver Lyle

Mr. Lyle, in a breezy, outspoken contribution, first stated the long-term dangers before us. There was going to be no rosy dawn, no golden sunset. They had been told that the B.E.A. would in the coming ten years need 30 million tons more coal ; the iron and steel industry would require something like 10 million tons more coking coal. Other users

would need 30 million tons more, and on top of all this there was an estimated shortage of 10 million tons—a total demand for 80 million tons more. The National Coal Board had given a figure of 13 million tons extra in the time. The picture was the reverse of rosy.

Mr. Lyle dealt at some length with the way industry must approach the problem of plant replacement, and said that the first stage must be to plan the multiple use of heat. Then new boilers and other plant must be put in to meet these requirements, and it was desirable for the boilers to work at the highest practicable pressure.

The speaker dealt with a question that, from the discussion, was of direct concern to many in the audience—the use of exhaust steam for electricity generation. If every factory and commercial premises generating 10,000 lb. of steam and over per hour installed back-pressure turbines and the B.E.A. co-operated in making surplus current, this would save the B.E.A. millions of tons of coal and would save the nation. The B.E.A. attitude towards the installation of plant to run in parallel with grid supply came in for some criticism, though Mr. Lyle said there was a different outlook at “the top.”

The final session was on fuel policy, with addresses by Sir Ewart Smith, who was in the Chair, and Mr. W. L. Boon. Sir Ewart outlined the ground that would have to be covered in the full national fuel policy that was needed, and said that this should be worked out as a result of an analysis of four aspects, which he put in the form of four questions: (1) What are the requirements to be met, not only at present, but estimated for the future? (2) What is the relative importance in the national interest of these requirements? (3) What resources are or can be made available to meet the requirements? (4) What action is required to balance supply and demand with the least strain on the economy? He stressed the fact that the technical and the economic aspects of the

national fuel policy must be integrated and each given proper weight.

The conference was summed up by Mr. Boon. He compared it with the 1946 conference on fuel and asked if we had done anything to help matters in the intervening years. Then did they see any co-ordination of policy between the gas industry and the electricity industry, both nationalized and each working, presumably, not in its own interests, but in those of the nation? There remained the same high walls as hitherto surrounding each industry.

Referring to the domestic coke consumer, Mr. Boon said that he was being “slightly denuded” of coke supplies by the gas industry owing to the use of coke for water gas manufacture. The domestic field was certainly being denuded of solid fuel, and hence more gas and electricity were being used. The gas industry was departing from its purpose as a two-fuel industry, and was considering itself as a complete gasification industry. This again was wrong. The industry was asking for a greater supply of coking coals and was denuding the domestic coke market. In the meantime would-be coke consumers were burning coking coals.

Deposit Gauges Standard

The British Standards Institution has issued a Standard for Deposit Gauges for Atmospheric Pollution (B.S. 1747: 1951), copies of which may be obtained from the Institution, 24 Victoria Street, London, S.W.1., for 2s. 6d., post-free. The Standard includes details of construction, siting, operation, analysis of deposited matter and statement of results, together with a standard report form for entering the monthly results. The Standard has been drawn up in accordance with recommendations based on the considerable experience of the D.S.I.R. and of local authorities.

First Smokeless Zones Inquiry

Salford's Scheme Examined

ONE of the provisions in the standard "smokeless zone" clauses in recent local legislation is that if there are objections to the establishment of any zone a public inquiry shall be held by the Ministry concerned. The first such inquiry took place on October 2nd, 1951, as a result of proposals and objections for setting up three smokeless zones in the city of Salford. The interesting fact about the Salford smokeless zones scheme is that, unlike those being planned by other towns, they include a considerable number of dwelling houses.

The inquiry was conducted by Col. G. E. Rhodes of the Ministry of Local Government and Planning (now Housing and Local Government) and the principal witness for Salford Corporation was Dr. J. L. Burn, Medical Officer of Health. Mr. F. Taylor, the Smoke Abatement Officer, Mr. J. W. Rodgers, of the North East Gas Board, and Mr. J. H. Orr, Sales Manager of Coalite and Chemical Products Ltd., also gave evidence.

There had been many signs of opposition to the scheme, and much newspaper and other controversy, but, according to the *Salford City Reporter*, "the opposition was by no means as vigorous and determined as had been expected and every speaker went out of his way to stress that he or she had no objection to smokeless zones as such." Even numerically, it was said, the opposition fell short of what had been anticipated and the case was left mainly to Mr. A. G. Anderson, for the Manchester and Salford Property Owners' Association.

Opening the Corporation's case, the Town Clerk, Mr. H. Tomson, C.B.E., said there were approximately 5,000 houses in the three zones, and 13,000 tons of smokeless fuel would be required for them annually. No one

had objected to the order on the ground that it was unnecessary; all the objections were that the time was not opportune, that smokeless fuel was not available, or if it were, that it would be more costly and would place an unfair burden on those who had to buy it.

"I have always found during my years of office," said Mr. Tomson, "that the time is always inopportune for improvements if they are going to cause people inconvenience or cost them money. Everything had to have a beginning and in due course we will probably extend these smokeless zones further."

Dr. Burn, in his evidence, said that existing conditions were having serious effects on health. Salford's mortality rate from bronchitis, averaged over eight years, was the highest of any large county borough in England and Wales—1,739 per million against an average of 718—while over half the old people suffered from crippling respiratory conditions.

"It is intolerable," he said "that this position should continue, and, therefore, the Corporation not merely *wish* to lessen the danger to life and health caused by smoke, but they are *forced* to take effective measures against the production of smoke." There was statistical evidence that the many and alarming deaths from lung cancer were related to the breathing of polluted air and reduction of sunshine due to the smoke pall.

A survey had revealed the amount of bituminous coal now consumed domestically to be 11,266 tons a year, an average of 16 cwt. per house. Smokeless fuels were used to the extent of 1,378 tons a year. The whole of the zones' requirements of 13,000 tons of solid smokeless fuel could be met by a variety of fuels such as coke, Coalite, Rexco, Phurnacite

and anthracite, all of which were smokeless.

Dr. Burn said there were 94 industrial and commercial undertakings in the zones, consuming 20,617 tons of bituminous coal each year, but of this 19,200 tons was used in the one plant of the Bradford Dyers' Association Ltd., at Kersal Moor, which was excluded from the order as it burned its coal in an effective manner.

Mr. Rodgers, for the Gas Board, said they could make 13,000 tons of smokeless fuel available each year. The Board was prepared to lay on gas, for ignition purposes, where no supply at present existed. He agreed that the coke stocks had deteriorated a little compared with last year, but said the Board would be prepared to import coke into Salford to meet the demand.

Replying to Mr. Walker, of the Weaste Owner Occupiers' Association, Mr. Rodgers agreed that a gas supply would only be laid on provided that the house-owners supplied and fitted, at their own expense, three gas points. It would not be worth while installing mains and a gas meter just for one gas poker.

Mr. Orr said Coalite required no special grate, and if anything was easier to ignite than coal. The initial cost was higher, but the fuel was cheaper in the long run as while the bulk was twice as great as coal it did not burn twice as fast. His firm could give a reasonable guarantee to supply 13,000 tons a year to Salford.

The Opposition

Mr. A. G. Anderson said his clients were not against smokeless zones as such, but against their introduction at the present time. He submitted that it was not practical to burn smokeless fuel in the existing grates so that the people affected could cook their food in the existing ovens. The fuel situation, he said, was in a shocking condition and last winter people in Salford were queuing for coke with buckets, bags and prams.

Arguments used by other representatives of bodies opposing the zones were to the effect that pollution came in

from other areas, that smokeless fuel was not satisfactory with ordinary ovens, and that whereas smoke from bituminous coal could be seen, coke fumes often affect a person without him knowing it. The one woman objector claimed that the high mortality from bronchitis had been attributed by leading medical authorities to the damp climate and not the smoke. Even so, she asked, was there anything wrong with the general health position of Salford when people could live to be a hundred there?

Another speaker said he considered the scheme to be ill-conceived, and "of a piecemeal nature," with no laid-down future. It ignored the Manchester and District planning proposals.

The Inspector spent the afternoon touring the area with his assessor, and said he would place his report before the Minister.

A Postscript

We have been shown a letter from our late Chairman, Mr. Charles Gandy, about the Salford smokeless zone proposals, and so typical is it of his inspiring outlook that some extracts must be printed for all to read. He wrote:

"Some things strike me forcibly. First, the immense service to smoke abatement already done by the preparatory work needed by Salford's proposals—some very considerable number of voluntary and official workers must have had a hand in it—and every home and factory visited has had it brought home to them that here is a problem which can be and is being tackled. That I think makes even more important the carrying to a successful conclusion of what had begun—if in Churchill's phrase we have come to 'the end of the beginning' of our fight with the dirty and acid-laden air which spoils life in our larger towns, we shall when the first smokeless zones are in operation know that we are at 'the beginning of the end.'"

“Secondly, the cost—even if it means some initial difficulty or disturbance of balance in fuel distribution or the expenditure of some thousands of pounds. It will mean what is worth more than anything—*hope* to those most needing the hope of better living conditions for their families. Perhaps one family in ten can move to new housing estates—the other nine stay more or less where they are with ‘jam tomorrow.’ I do not think it is too much to say that

such proof that the authorities in Salford are really meaning business in the matter of improving living and working conditions for its great working population will help to give a better spirit to all—and to remove some of that feeling of frustration which is one cause of discontent and delinquency. So the cost will be amply repaid. Those in the smokeless zones will have, too, a vested interest in their extension—and those outside will take warning.”

Electricity Review

The Third Report of the B. E. A.

TO anyone who has visions of a smokeless society to which electricity must make a very considerable contribution, the third report of the British Electricity Authority will be of great interest. The report with its many tables deals comprehensively with the generation, main transmission by the grid, distribution, research, and finance, and discloses the very rapid rate at which the public electricity supply is developing.

At March 31st, 1951 the Authority owned 289 power stations with an installed capacity of 14.5 million kilowatts comprising 14.3 million kilowatts steam plant, 64,000 kilowatts internal combustion engine plant, and 173,000 kilowatt hydro plant, giving a maximum output capacity of 13.1 million kilowatts. Three new large power stations were brought into commission during the year, viz., Croydon B, Agcroft (Salford) and Poole, together with new sections of existing stations at Stourport B, Portobello and Peterborough. It is of interest to note that at Stourport and Portobello the steam pressure is 1,250 and 1,350 lbs. per square inch respectively, at Portobello one 60,000 kilowatt set being supplied with steam from a boiler with 540,000 lbs. per hour evaporation capacity, the Authority's largest boiler.

The plant programmes for 1946-1956 aggregate 12.3 million kilowatts but in spite of this many of the older plants of low efficiency have had to be kept in commission to meet the increasing demand. With the increasing efficiency of the new stations however, the overall

efficiency of generation has risen from 20.86 per cent in 1948 to 21.54 per cent in 1951. The programme includes four 100,000 kilowatt sets to be installed at Castle Donnington, Willington (Derbyshire) and Ferrybridge.

17.7 per cent. of the maximum output capacity providing 8.7 per cent. of the actual output is generated at stations having thermal efficiencies of under 16 per cent. It is interesting to speculate whether, if and when any of these stations become redundant, they are suitable and conveniently situated with regard to new development areas to justify their conversion to non-condensing stations as centres of heat supply for district heating schemes.

Two house service sets each of 1,350 kilowatts were brought into commission at Battersea, the exhaust steam at 17 lbs. per square inch being transmitted under the river to the Pimlico district heating scheme of the Westminster City Council, referred to in Summer, 1950 number of SMOKELESS AIR. This scheme should provide useful data concerning the supply of heat from thermal-electric sources.

The grid, as the result of transfer of many 66 kv. overhead lines to the area Boards, has 1,202 route miles of 66 kv. lines less than in the previous year. It has 4,037 miles of 132 kv. lines, of which 3,992 are overhead and 45 miles are underground. 265 further route miles of 132 kv. lines were put in hand during the year. It is of interest to note that a new grid operating at 275 kv. is being constructed ultimately to extend from Glasgow to

Tilbury and Melksham.

Coal consumed in the power stations of the Authority during the year amounted to 32.68 million tons, to which figure it has risen from 16 million tons in 1938. At the present rate of expansion, even allowing for the increasing efficiency of the thermal cycle, it seems that coal requirements in 1960 will be over 45 million tons. At this rate it will require a large portion of the increased output of coal in the programme of the National Coal Board.

The total output of the Board during the year amounted to 46,580 million units, an increase on 1949-50 of 5 million units, or 12.3 per cent. Supplies to farms have increased in two years from 248 to 480 million units. 160 million units were purchased from the North of Scotland Hydro-Electric Board and 243 million from private power stations. There was supplied to the Southern Region of the Railway Executive 283 million units at 25 cycles and 276 million units at 50 cycles. It is proposed to turn over the

25 cycle supply to 50 cycles.

Chapter 3 of the report gives an account of the operation of the grid supply during a winter day during which the grid was called upon to transmit large blocks of power from one part of the country to another, a function for which it was not designed. This is of particular interest in setting out the nature and magnitude of some of the operating problems the grid is called upon to meet. The problems may be eased by the new 275 kv. grid referred to above.

The surplus made by the Authority and the Area Boards, on the undertaking involving a capital of some seven hundred million pounds is, after meeting interest charges, some six and a third million pounds, three quarters of a million pounds less than the previous year. The average revenue per unit fell from 1.2d. to 1.181d., while cost of electricity per unit rose from 0.549d. to 0.557d.

The report mentions that the Authority has during the year become a member of the National Smoke Abatement Society.

The New Parliament

The new Parliament includes many members who have shown their interest in air pollution problems, including our Vice-President, E. H. Keeling, and Antony Greenwood, whose address on the subject was reported in a recent issue. We are also glad to see a member of the Society, who was for a time on the Executive Council, back again in the House—Major S. F. Markham, author of *Climate and the Energy of Nations*.

There were several questions to the new Government on smoke abatement matters during the first week or two of the new Parliament. In the Debate on the Address it was interesting to note that Mr. Charles Fletcher-Cooke (C. Darwen) had apologised to Mr. Antony Greenwood (Lab. Rossendale) for the invasion of the latter's constituency by Darwen's smoke. "The smoke from the high chimneys," he said, "pours over the terraced houses, as it has done for a hundred years. I am afraid that some of it blows eastwards into the division of Rossendale, and that has caused the hon. Member for Rossendale some concern

over smokeless fuel. I share his concern, and I apologise for the invasion that my division causes."

This is a most commendable innovation, for it has always seemed likely that smoke will be well on the way out when it is looked upon as a breach of good manners. Other M.Ps., Mayors, Town Councils, Boards of Directors, etc., please note!

Electric Vehicles

The importance of the electric vehicle in the reduction of atmospheric pollution due to road traffic is something that has, in the past, been stressed by the Society. It is hoped to publish an article on the subject in our next issue, but in the meantime attention may be drawn to a new booklet issued by the Electric Vehicle Association (2 Savoy Hill, London, W.C.2). This deals in particular with the value of this cleaner and fumeless form of traction for local deliveries and collections. There are five times as many electric vehicles in use in Great Britain today as there were before the war.

Visit to Corby

A meeting of members of the Council of the East Midlands Division was held at Corby, Northants, on October 24th. During the afternoon a visit was made to the works of Messrs. Stewart and Lloyds.

Since 1930 Corby has grown from a small village to a township of 16,000 as a result of the erection of one of the biggest iron and steel works in the country. It is seriously affected by the pollution arising from the manifold processes, and there has been much local controversy. Last year an excellent detailed report was drawn up by the Chief Sanitary Inspector to the U.D.C., Mr. G. H. Wilkinson. This report shows that among the main causes of pollution from the works are the coke ovens, sintering plant, blast furnaces, bessemer converters, and internal coal-fired locomotives. The bulk of the emissions are grit and dust, rather than smoke as such.

The inspection of the plant—or at least as much as could be seen during an afternoon—was most instructive, quite apart from the pollution problems, and thanks to the management were extended during the course of the tea at which the party was afterwards entertained. The General Manager, Mr. J. Glen, explained what was being done to reduce the pollution. Some of the points mentioned will be of general interest.

Thus on the blast furnace problem, Stewart and Lloyds have just completed the replacement of the furnace tops with a new design that is gas-tight and is said to be in advance of any other furnace top in the country. The capacity of the gas cleaning plant has been increased, with new wet-washing towers and electrostatic de-dusting units. Apart from giving cleaner gas this has reduced furnace top pressure and with it the tendency of the bleeders or safety valves to open during operation.

Trouble due to “hanging” and “slipping” of charges has been

reduced by the installation of a modern ore preparation plant to give smoother operation. It is stated that no form of de-dusting equipment will prevent dust emission during furnace slips.

In the sintering process iron ore and coke dust, once largely discarded, is heated with a gas flame by spreading on a travelling chain grate. The air used for combustion is charged with dust, some of which is removed by passing the air through large hoopers. The gases issuing from the chimneys are nevertheless very dusty. A large new sinter plant is now in course of erection, of which £50,000 out of a total cost of £250,000 will be for centicell dust extraction plant.

Coke ovens are invariably a source of trouble and Stewart and Lloyds were asked (in Mr. Wilkinson's report) to incorporate up-to-date improvements in any new plant and to consider the use of self-sealing as opposed to clay-sealed doors. This was 18 months ago, and the firm is now trying a new, simplified door that is thought to be a considerable advance on the old type of seal. Plans are in hand for converting 248 old doors of the battery to this new type. A new battery under erection will be provided with double collecting mains and new shaker feed cars to allow faster charging.

Another interesting development is the installation of plant for the removal of sulphur from all coke oven gas.

As regards the 56 steam locomotives in use in the works—and which it was evident were responsible for much of the pollution—a few diesels are in use or on order, and the company is keeping the question of further use of diesels under review. They say that the high capital cost involved, the difficulties of delivery, and the question of whether diesels are suitable for all requirements, make careful consideration necessary.

It is difficult, in such summary form, to give a correct and complete



From our Photo-Library—11

(Kettering Evening Telegraph Photo.)

Corby

picture of the problem as a whole, but enough has been touched on to show that, on the one hand the matter is a most serious one for the people of Corby, and on the other that the company has a difficult and complex task in attempting to overcome it. It is already doing a great deal, but whether this is enough, and if not how much more can be done and by when, are questions for technical discussion.

Every iron and steel works has a number of admittedly difficult and independent problems to solve before it is able to cease polluting the atmosphere. They can only be solved by extensive research, experiment, and genuine determination. Encouraging changes in the social attitude of the industry, as compared with even twenty years ago, are now evident: changes it will pay the smoke prevention movement to foster by friendly co-operation and a practical understanding of the problems involved.

North West Division

"The general aspects of grit and dust collection from industrial chimneys" was the title of a paper by J. C. Cleeves at a joint meeting of the North

West Division and the North West Section, Institute of Fuel, in Manchester on October 17th. S. N. Duguid was in the Chair.

Mr. Cleeves explained at the outset that the subject was very wide and that he had prepared his paper to be of interest and help to those concerned with comparatively small industrial plants, and would deal with grit and dust within the range of 5 to 200 microns diameter. He gave typical examples of the varied sizes of grit, etc., from boilers fired by the chain grade and spreader stokers and by pulverised fuel. The five chief types of collector were described and the principles of operation explained with comment upon the advantages and disadvantages, and the initial outlay involved in installation.

Yorkshire Division

We go to press just before the annual general meeting of the Yorkshire Division, on November 20th, in Leeds. The principal item on the programme was an address by Dr. A. Parker, Director of Fuel Research, on the work of the Department of Scientific and Industrial Research, in relation to air pollution.

Hard Coke

By J. P. Graham

THE rationing of solid fuels used for domestic purposes has to some extent created an artificial position in Great Britain so far as the domestic utilization of fuel is concerned. In 1938, when no such restrictions existed, it was estimated that approximately one-third of our national coal-production each year was ultimately used in the form of coal, coke, gas or electricity consumed for domestic purposes. In spite of this fact the heating services in the average British home, that is, space heating, hot water heating and cooking, are by no means entirely satisfactory. Much has been done in recent years to improve the efficiency of domestic fuel consuming appliances. The report of the Fuel and Power Advisory Council on domestic fuel policy published in 1946 recommended that the target of a national domestic fuel policy should be to secure that the 50,000,000 tons of bituminous coal now burned with a working efficiency of 20 per cent. should be replaced in twenty years by smokeless solid fuel or by bituminous coal burned smokelessly or by gas or by electricity with an average coal economy efficiency of not less than 40 per cent.

Hard coke, that is coke produced from carbonization of coal in a coke oven, is an important solid smokeless fuel with wide application in the domestic field. It is a fuel which can play an important part in the ultimate achievement in the aims of the Fuel and Power Advisory Council's Report.

Manufacture and Uses of Hard Coke

The coking industry of Great Britain carbonizes about 23 million tons of coal per annum from which over 15½ million tons of coke are produced. The coke is used mainly by the metallurgical industries, over 10 million tons being used in blast furnaces for the production of iron; approximately 1 million tons for foundries and some 2½ million tons for general industrial use. Apart from a small quantity which is exported the remainder, amounting to something of the order of 1 million tons, is utilized for domestic purposes.

Historically, the development of the coke making process in the coking

industry is a fascinating subject. The fuel originally used for the early blast furnaces was charcoal but as the iron making industry developed this fuel was replaced by coal and later by coke. The early cokes used were made in heaps, the process being similar to that of charcoal burning. The manufacture of coke first became of importance in this country about the year 1640 for drying malt for the brewing of beer and subsequently for the smelting of lead, the calcining of lime and for smiths hearths. For many years during the nineteenth century coke was the only fuel used on the railways. It was however, the iron and steel industry which was responsible for the greatest expansion in the manufacture of hard coke. During the latter half of the nineteenth century, beehive ovens were operated in considerable numbers. These were of very simple design and the operators were not concerned with the recovery of by-products.

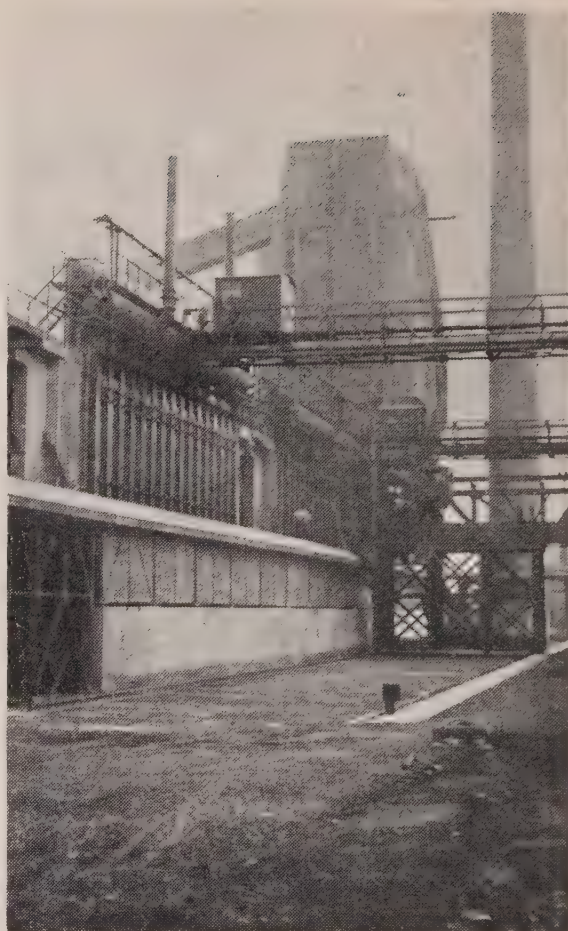
About 1884 experiments were performed at blast furnaces in the north of England using what was then termed "patent coke" manufactured in a battery of rectangular type coke ovens fitted with by-product recovery equipment. At the time considerable prejudice was exhibited by iron-makers against the introduction of patent coke but it was soon realized that this coke was not only far more economical to manufacture than the beehive product because of the recovery of by-products, but the coke itself proved suitable for use in the taller types of blast furnaces which were then being built. The establishment of the by-product recovery principle was an important step in the development of the carbonization process. Modern coking practice, with the extensive mechanization of coke ovens and the introduction of more rapid methods of production was originally developed to a large extent during the first world war in the United States of America. Similar ideas were being pursued about the same time in Great Britain and on the Continent of Europe, and have now become accepted practice throughout the world.

The coking plants in Great Britain fall into three categories so far as ownership

is concerned. The National Coal Board owns 51 coking plants ; the iron and steel industry operates 23 plants and independent companies operate 9 plants. The gas industry also operates 2 coke oven plants. It should be mentioned that the capacity of the various constituent sections of the coking industry is not proportional to the number of plants owned by each section. In general the coking plants owned by the iron and steel industry are individually larger units and the 23 plants use between them nearly half the coal carbonized in coke ovens in Great Britain. The coking industry is at present carrying out extensive constructional programmes and the capacity of the industry is being increased. Parallel with this expansion a large part of the industry's research effort is being directed to studies of blending and modification of carbonizing practice which have an important bearing upon the domestic utilization of hard coke.

Modern coke ovens are usually about 40 ft. long, 12 to 14 ft. high and about 18 in. wide. They are erected in batteries, the number of ovens in a battery varying from 10 or 12 to as many as 60 or 80. The latest trend in construction in this country is to erect the ovens in relatively small blocks of not more than 25 ovens in order to facilitate the rebuilding of the plant in sections when this becomes necessary. The ovens themselves are built with high quality refractory brickwork and are separated from one another by heating flues so that each oven is heated simultaneously from both sides of the charge of coal. The heating medium is either "rich" gas, that is coal gas produced in the process of carbonization itself, or "lean" gas, that is producer gas or blast furnace gas. Whilst the process of carbonization in an individual oven is a "batch" process and therefore intermittent, the overall production from a battery of coke ovens is continuous as the charging and discharging of the ovens is carried out to a predetermined schedule in order to ensure continuity of production.

Coal of suitable quality is charged into the top of the oven from the hoppers of a charging car which runs along the top of the oven battery. Each oven on a modern coke oven plant has a capacity of some 20 tons of coal and by employing suitable blending equipment on the coking plant it is possible to mix or blend various coals in defined proportions in order to obtain consistency of the blend to be carbonized.



Coke oven battery, showing pusher side

This is of great significance as the quality of the coals charged is the most important factor influencing the quality of the coke produced. The coals used are crushed to approximately $\frac{1}{8}$ in. in size before carbonization. At the end of a coking period lasting some 18 to 20 hours the doors at each end of the oven are removed and the hot coke is discharged from the oven by means of a ram into a coke car. The oven doors are then replaced, the oven recharged and the process repeated. The coke car is pushed (by an electric locomotive) under a quenching tower where a controlled quantity of water is sprayed on to the hot coke in order to cool it. The coke is then discharged on to a wharf from which it is removed by means of conveyor belts to the screening plant where sizing of the various grades takes place.

On heating coal, the volatile matter in the coal substance is driven off in the form of crude gas. At the coke oven plant this gas, which contains the valuable by-products, is collected during the carbonization process. The volatile matter driven off is treated in various types of equipment and produces the by-products

—tar, ammonia and benzol. These are known as primary by-products and may later receive treatment either at the coke oven plant or at other chemical works where innumerable materials may be obtained. For example benzene is produced for use as motor fuel or as the raw material for many chemical processes; toluene is made for the explosives industry and various pharmaceutical products prepared by subsequent treatment. Modern types of disinfectants and antiseptics are also derivatives of the by-products of coal carbonization. A full account of the by-products which it is possible to obtain would be far too extensive for an article of this scope, but it may be useful just to indicate the quantities of primary by-products which are made when one ton of coal is carbonized in a coke oven plant. Apart from some $14\frac{1}{2}$ cwt. of coke about 3 gallons of benzol are produced, together with 9 gallons of tar, approximately 20 lb. of sulphate of ammonia and about 12,000 cu. ft. of coal gas of high calorific value.

Properties of hard coke and their influence in utilization

The value of any coke for particular purposes can be assessed to some extent by the well-known laboratory tests which give a measure of its chemical and physical properties and there are, in addition, other tests of a more arbitrary character which have been designed to provide information as to the suitability of coke for some particular type of usage.

Combustion of coke in domestic appliances shows that equal importance cannot be attached to each of the properties and that one of the governing factors is the slow rate of combustion which must be maintained at certain periods. At such times there is a tendency for the temperature of the fuel bed to drop and active combustion becomes difficult to maintain. This throws emphasis upon the combustion characteristics of coke for domestic use. Irregular or incorrect sizing of the coke is immediately reflected in the performance of any domestic appliance and this fact reveals that size is a most important criterion in determining the most suitable cokes for domestic use. Accumulation of ash is soon apparent in an open fire and quickly affects the performance of a closed stove, particularly when the ash fusion temperature is low, causing clinker to form on the grate bars. What then are the characteristics of coke which are of

primary significance as far as utilization in domestic appliances is concerned, bearing in mind the "open" and "closed" types of appliance?

(a) Chemical composition

High moisture is undesirable economically for the simple reason that the consumer objects to paying money for weight which is supposed to be fuel. From the point of view of combustion, excess moisture has to be driven off and therefore reduces efficiency. Some moisture up to the order of 5 per cent. is desirable as a means of preventing the possibility of a dust nuisance.

The low volatile matter content of coke constitutes one of the primary factors as regards its combustion. If coal is burned in an ordinary grate the considerable amount of volatile matter which is driven off means that a large proportion of the heat in the coal is liberated above the fuel bed. Thus the temperature at the grate with coke firing is higher than when coal is burned under similar conditions of heat liberation.

The ash content is important both economically and technically. Accumulation of ash on the surface of coke in an open fire reduces the radiation and an excessive accumulation on the grate bars in both closed and open appliances offers resistance to the passage of air, thus adversely affecting combustion, particularly at low rates. The nature of the ash is also of great importance, a voluminous ash or one having a low fusion point offers the greatest resistance to the flow of air. The presence of sulphur is undesirable and the lower the sulphur content the better the coke is for use in domestic appliances. Calorific value is similarly a simple case, the higher the calorific value, the better the overall performance of the appliance.

(b) Physical characteristics

The shatter index is of primary importance in that it is a measure of resistance to breakage during transit and handling generally. It is therefore of the utmost importance to the householder as it helps to ensure that the size of coke which was ordered will have suffered the minimum of breakdown between the oven and the appliance if the shatter index is fairly high. Strength is also of considerable importance in the fuel bed ensuring as it does the maintenance of the voidage between pieces of coke in the bed.

Bulk density is another factor which affects the economics of domestic utilization of coke as well as its performance in

an appliance. High bulk density of oven coke is a considerable advantage from the point of view of storage and in the "closed" appliance, enabling the maximum weight of fuel to be put into the fixed firepot capacity and thus helping to facilitate overnight combustion. High bulk density is a disadvantage in "open" appliances as it tends to reduce the ease of ignition and increase the time taken for the fire to pull through.

Reactivity as measured by the C.A.B. test gives a measure of flexibility in use. The critical air blast test, which was devised in the Northern Coke Research Committee laboratories, aims at determining by trial and error the minimum rate of air blast which will maintain combustion in an ignited bed of closely graded fuel contained in a glass or quartz tube of specified dimensions. The method after modification has been adopted as a British Standard. The more reactive the fuel the lower its C.A.B. value, and values vary from between 0.03 for wood charcoal to 0.07 or more for an unreactive hard coke. The C.A.B. is measured in cubic feet per minute at 60°F. and 30 in. mercury pressure (dry gas). In considering the combustion of coke in domestic appliances, it is perhaps best to examine reactivity in conjunction with bulk density. For example, a fuel of high bulk density and high C.A.B. value

would require increased gas for ignition but the longer time to pull through would be compensated by less frequent refuelling and more effective use of storage space. Generally speaking reactivity is more significant in "open" fire appliances than in "closed" types and further its importance diminishes with increased size of appliance.

(c) Size

There is no doubt that size is the most important single factor in the combustion of coke, and it is particularly critical in the smaller type of domestic appliance. The need for accurate sizing, close grading and a reduction in the number of different sizes sold cannot be over-emphasized.

When coke is burnt in an open grate, slow combustion stove, domestic boiler or small central heating boiler, there is a tendency at certain times for the temperature of the fuel bed to fall so low that active combustion cannot be maintained. This is caused by the low combustion per square foot of grate area. Extinction of the fire is particularly liable to occur if the coke is too large, but on the other hand if it is too small clinker formation can be great and the penetration of air through the fuel bed might be limited.

In 1940 the first attempt to deal on a national scale with the problem of hard coke sizes was made by the British Hard Coke Association. War conditions prevented the development of the work but the British Coke Research Association has since taken up the work on the specification of coke sizes and the determination of the most suitable sizes for specific uses.

The following sizes of hard coke are given as a guide to the domestic consumer:

Domestic Appliance	Size Range
Open fires (modern types including convector fires fitted with bar grates)	1 to 2½ in.
	1 to 2 in.
	¾ to 1 in.
Stoves (open-closed types)	1 to 2 in.
Small domestic boilers	¾ to 1 in.
Large domestic boilers	1 to 2 in.
Small central heating boilers (50,000 to 150,000 B.Th.U.)	1 to 2½ in.
Cookers, freestanding :	
(a) Heat Storage	¾ to 1 in.
(b) Heat insulated	
Combination Grates	1 to 2 in.

It is anticipated that the outcome of the research work mentioned above will be the establishment of a limited number of size grades which will become an accepted standard for the coking industry. The recommendations are expected to be publicized in the near future.



Coke being discharged from the oven into the coke bar

Domestic Use of Hard Coke

It must be remembered that the various heat services can be provided in many different ways by choosing various combinations of appliances. Different designs of houses lend themselves to different arrangements and combinations of appliances, the efficiency of which may vary greatly in practice. Generalizations on the best choice of appliance for a particular heat service are therefore extremely difficult. For example, many types of appliance serve a dual purpose, providing both hot water and space heating as in the case of the open fire fitted with a back boiler. However, it is true to say that hard coke has proved to be a satisfactory fuel for all the main heat services required. Its use may be considered under four main headings :

(a) Hot water heating ; (b) Central heating ; (c) Open fires ; (d) Cooking.

(a) Hot water heating

The hot water requirements of the average home are extremely difficult to assess but the Egerton Report recommends that the installation should be capable of supplying 250 gallons of water at 140°F. weekly. This quantity would be sufficient to provide seven hot baths per week, ten washes per day at a basin, normal washing up and house cleaning requirements and fifty gallons per week for laundry. Coke can be employed as the heating medium in the following types of appliance for the provision of hot water : (i) Open fire with back boiler ; (ii) Heating stove with back boiler ; (iii) Hot water boiler ; (iv) Central heating boiler.

The open fire or heating stove with back boiler are simple means of providing hot water supplies in the winter months and whilst the system is by no means ideal for all needs, it is reasonably effective where the services required do not justify two separate appliances for space heating and hot water supply. Approximate figures for the distribution of the heat output are 23 per cent as hot water and 32 per cent. as space heating, expressed in percentages of the available heat in the fuel. The weekly consumption of coke in an appliance of this type would be from 1 to 1 $\frac{3}{4}$ cwt.

The latest types of small hot water boilers are most efficient and hard coke is an ideal fuel for this type of appliance. Minimum standards in design and capacity now recommended make for reduced fuel consumption and ease of operation.

Refinements such as simple forms of thermostatic control and improved air control make this an extremely satisfactory appliance.

(b) Central Heating

Hard Coke is a very suitable fuel for central heating boilers of all sizes and as a means of providing "basic" warmth in a dwelling, the system using low pressure water radiators has much to recommend it. Frequently central heating is regarded as being very costly but in actual fact a simple system of this type can be installed which compares favourably with other space heating systems as regards fuel cost. Such a system would comprise a small central heating boiler of not less than 30,000 B.Th.U. per hour capacity together with the necessary pipes and radiators. A small amount of supplementary heating would probably be required for "topping up" in the coldest weather. The principle types of solid fuel appliance available for central heating services are the hand fired boiler and the gravity boiler. In both these, hard coke is a satisfactory fuel but in the case of the gravity feed type the importance of close sizing of the coke and the avoidance of "fingery pieces" must be emphasized if operation is to be efficient.

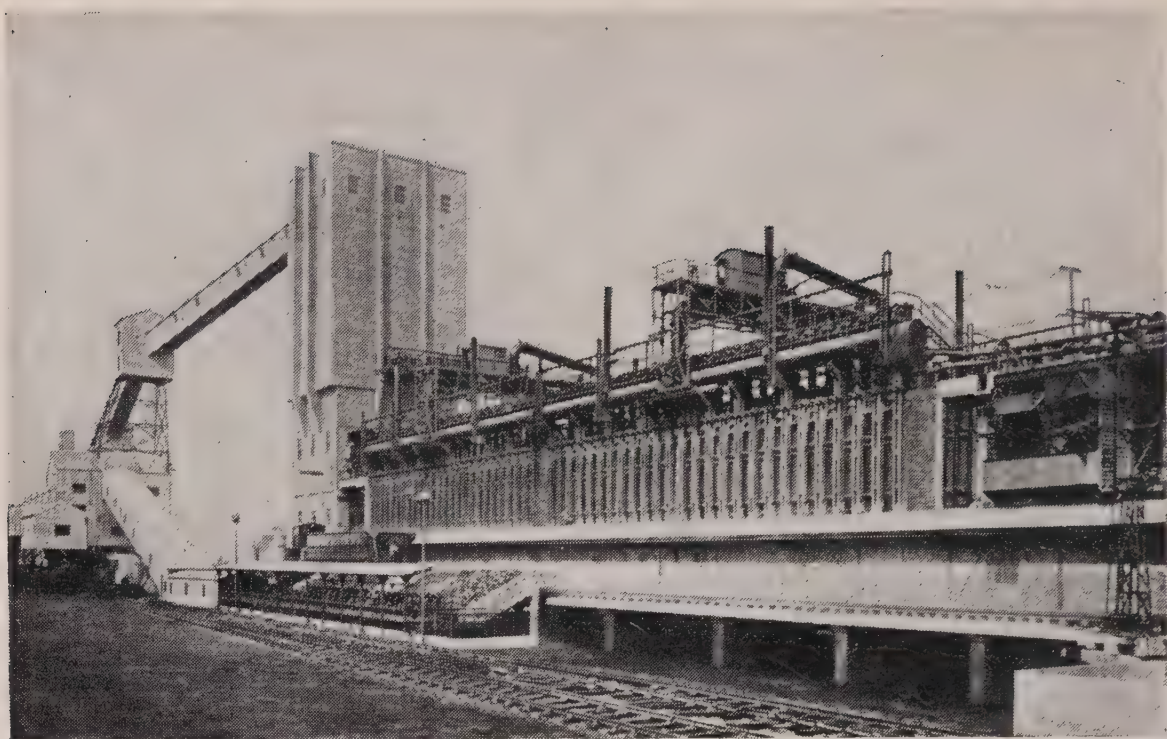
(c) Open fires

In the modern type of solid smokeless fuel burning open fire, coke is a much more efficient fuel than coal. The convector type of open fire is so designed that air can circulate around the sides and back of the fire. The warm air produced then passes into the room containing the appliance or is conveyed through ducts to a bedroom above. With some of the latest types of appliance coke fires can be maintained for periods of ten hours at a slow rate of combustion, thereby enabling overnight burning to be achieved.

Under this heading must also be included the openable stove. This appliance has become increasingly popular and again coke is one of the most suitable fuels.

(d) Cooking

Small sizes of hard coke are suitable for use in the type of solid smokeless fuel cookers recently developed. As in the case of gravity fired central heating boilers, close sizing and regularity is of the greatest importance. Two general types of cooker are in use and whilst they are similar in outward appearance, the principles upon which they operate are



General view of coke oven battery

quite different. One, the heat storage type consists of heavy metal castings in which the heat derived from the burning fuel is retained until required. The remaining type known usually as insulated cooking stoves has no such heavy castings and must be operated at a high rate of combustion before cooking temperature is attained.

The efficiency of combustion using hard coke

The performance of hard coke in the appliances described above compares favourably with other smokeless fuels on practically every count. Tests carried out recently have shown that in some cases hard coke gives very favourable efficiency figures. For example a series of tests were carried out with different sizes of hard coke in a small domestic hot water boiler of 0.75 cu. ft. capacity and a water surface rated 25,000 B.Th.U. per hour. Hard cokes gave thermal efficiencies of over 75 per cent. at the rated capacity of the boiler. Domestic hot water boilers of the smallest types with a fuel capacity of 0.6 cu. ft. will provide 250 gallons of hot water per week. With care they can be made to give continuous hot water with a fuel consumption of less than 1 cwt. of coke per week.

Work has also been done on cookers using hard coke and other fuels. Results showed that hard coke of suitable sizes is as satisfactory and as economical as other smokeless fuels for use in such an

appliance.

The latest types of open fires incorporating convector heating with a back boiler may provide an efficiency of 65 per cent. This figure shows the considerable improvement when it is remembered that the ordinary type of coal fire which has been the conventional heating unit in this country for many years has an efficiency seldom rising above 25 per cent.

Another type of space heating appliance in which hard coke can be used is the domestic heating stove which may have a back boiler fitted. The door provided allows the fire to be exposed and with the door open the efficiency is comparable with that of a convector fire. This type of stove will remain alight overnight if the doors are closed and very low rates of combustion are achieved. Continuous combustion is achieved with a fuel consumption of $\frac{3}{4}$ -1 $\frac{1}{4}$ cwt. per week.

Hard coke is well established in the sphere of domestic utilization. Properly prepared hard coke is a most satisfactory fuel for domestic water heating, central heating, cooking and space heating. From a consideration of the advantages and disadvantages of the various solid fuels as regard bulk density, ash, calorific value and the other factors influencing performance it may safely be claimed that hard coke has an important place in the domestic fuel market and that its use for such purposes will expand in future years.

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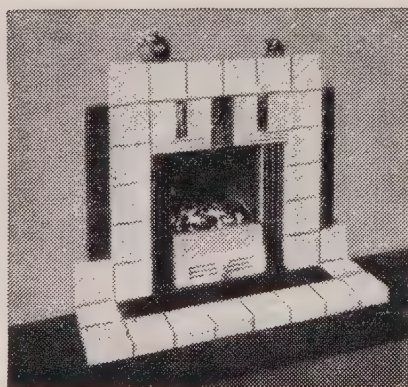
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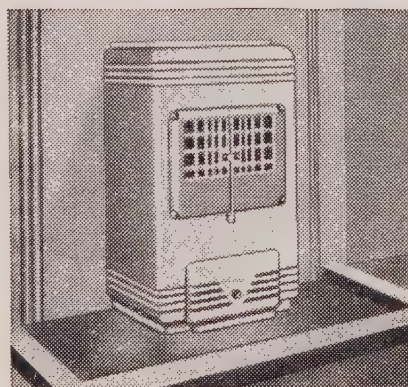
(left) Smokeless open fire with gas-ignition. Can be fitted with convection heating and back boiler.



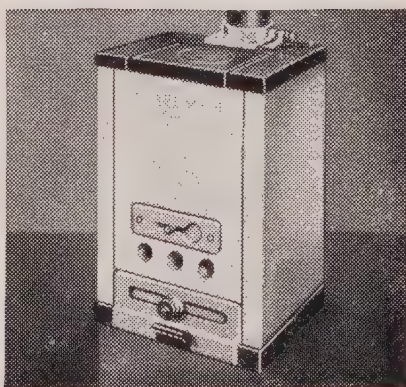
(right) A free-standing insulated cooker with hot water supply.



(left) Free-standing continuous burning heating stove, openable type.



(right) A modern domestic boiler which can be fitted with thermostat control.



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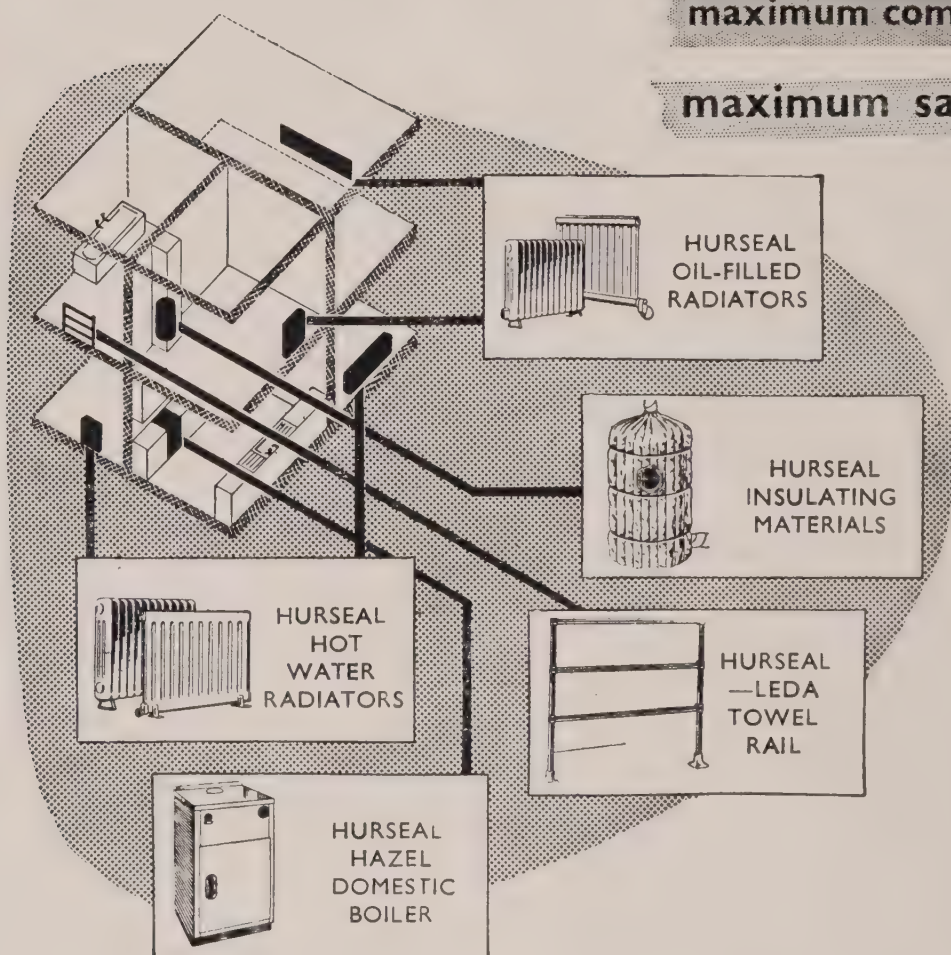
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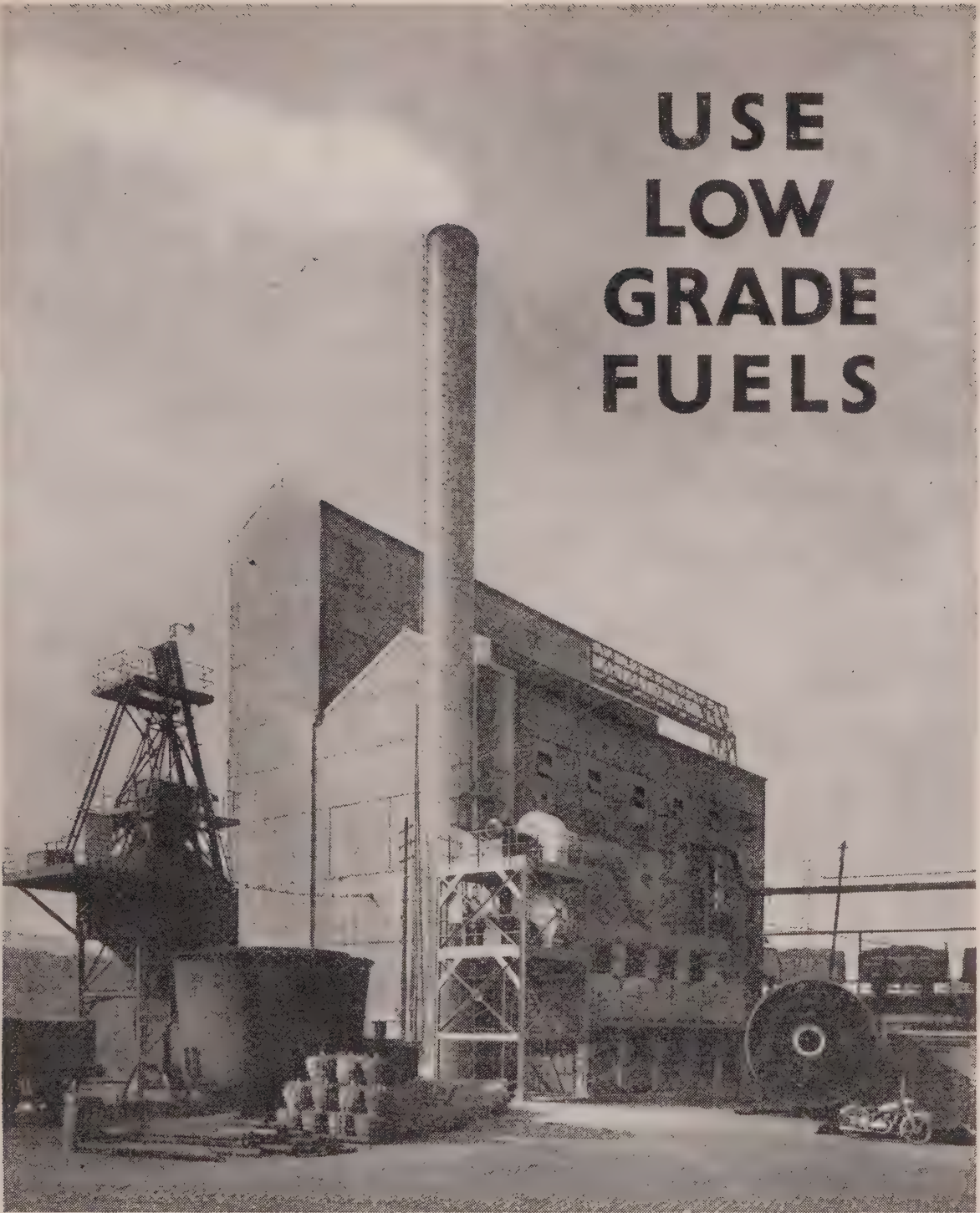


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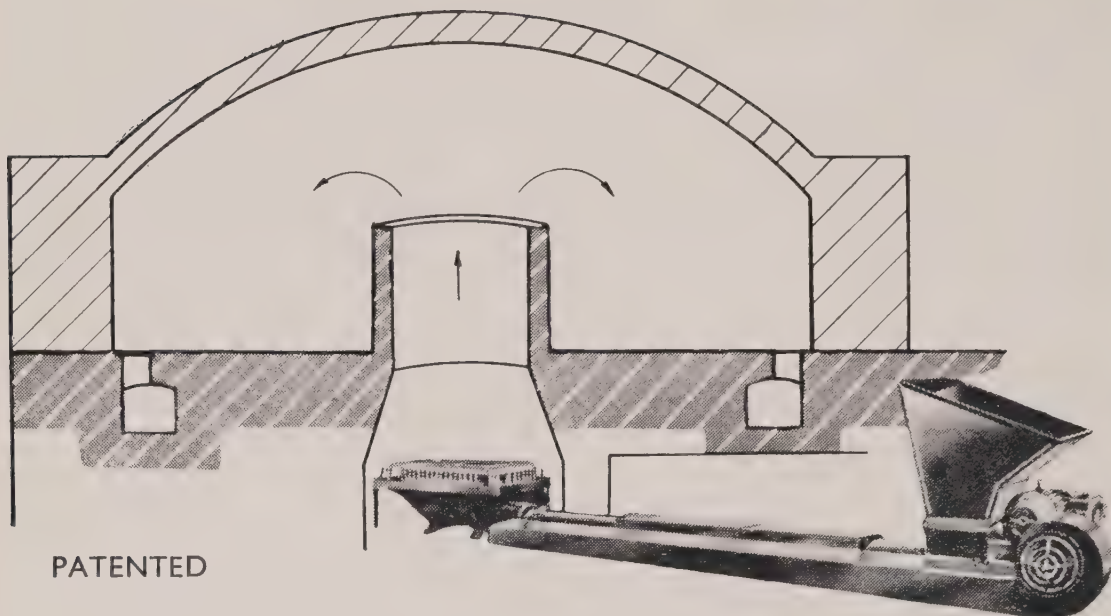
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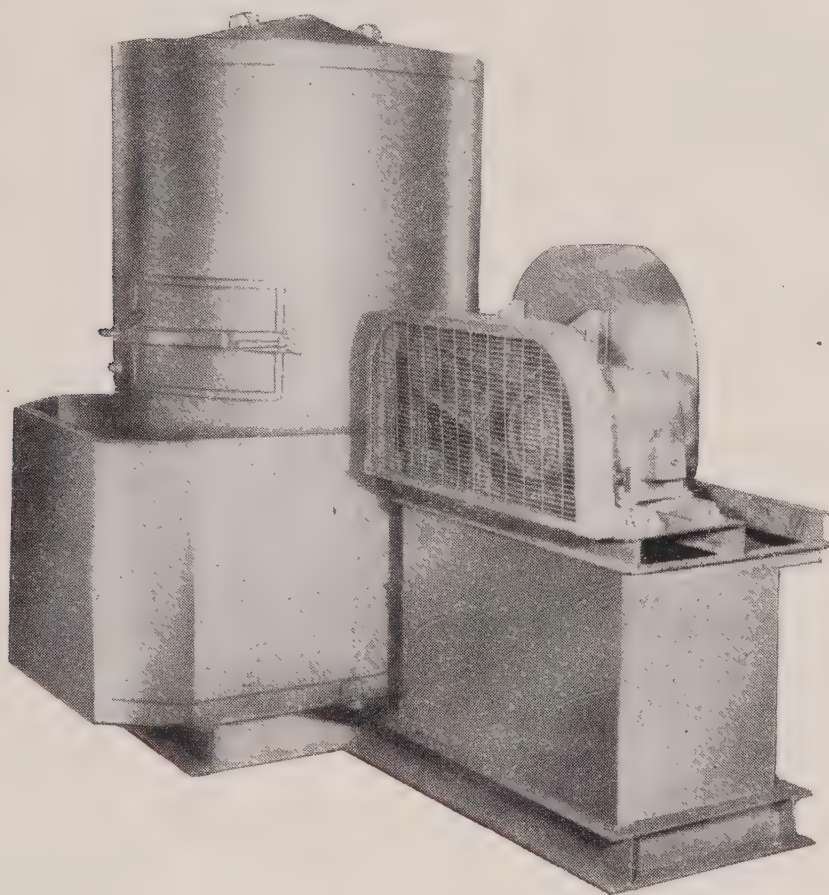
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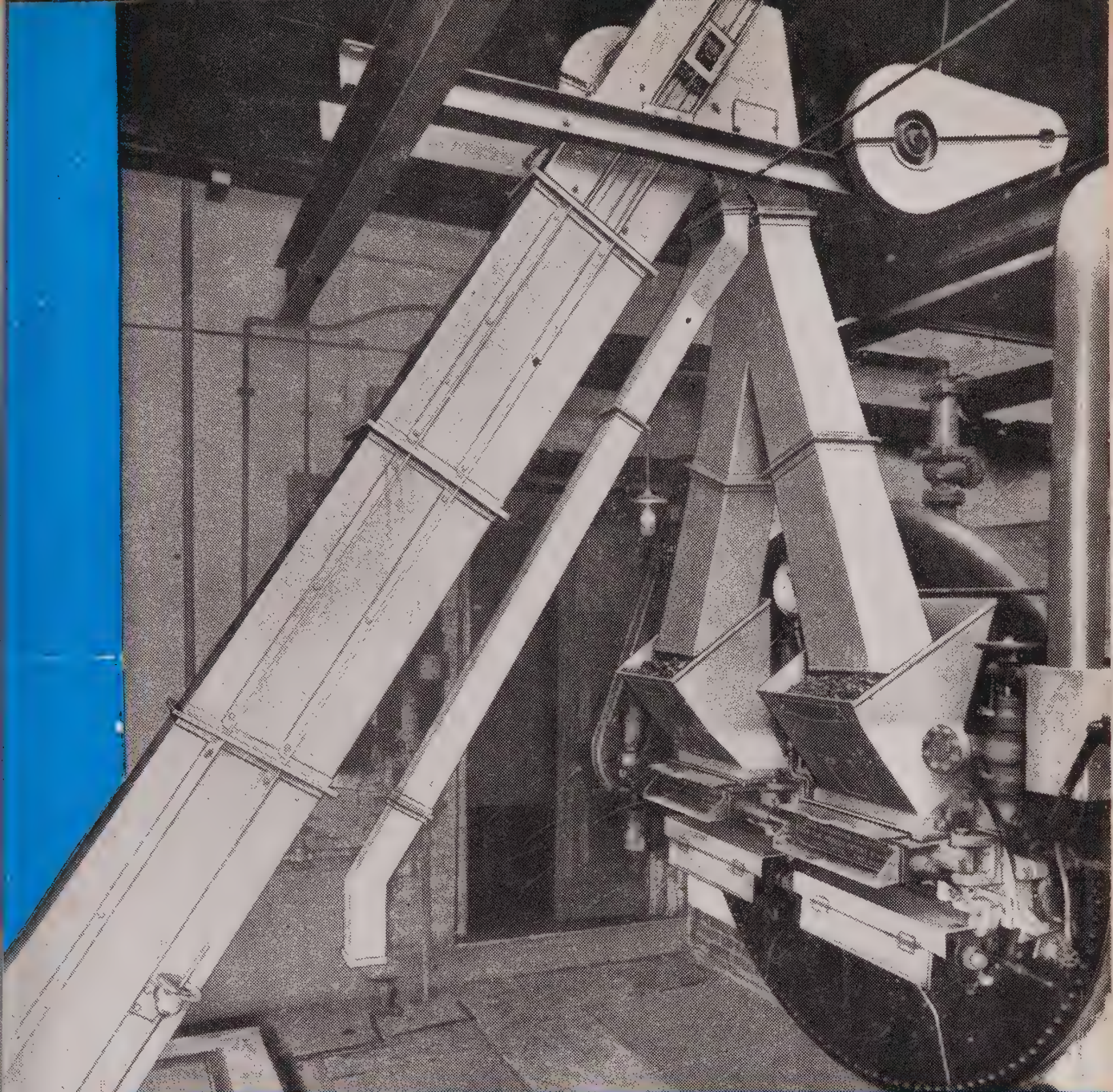


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In this Issue

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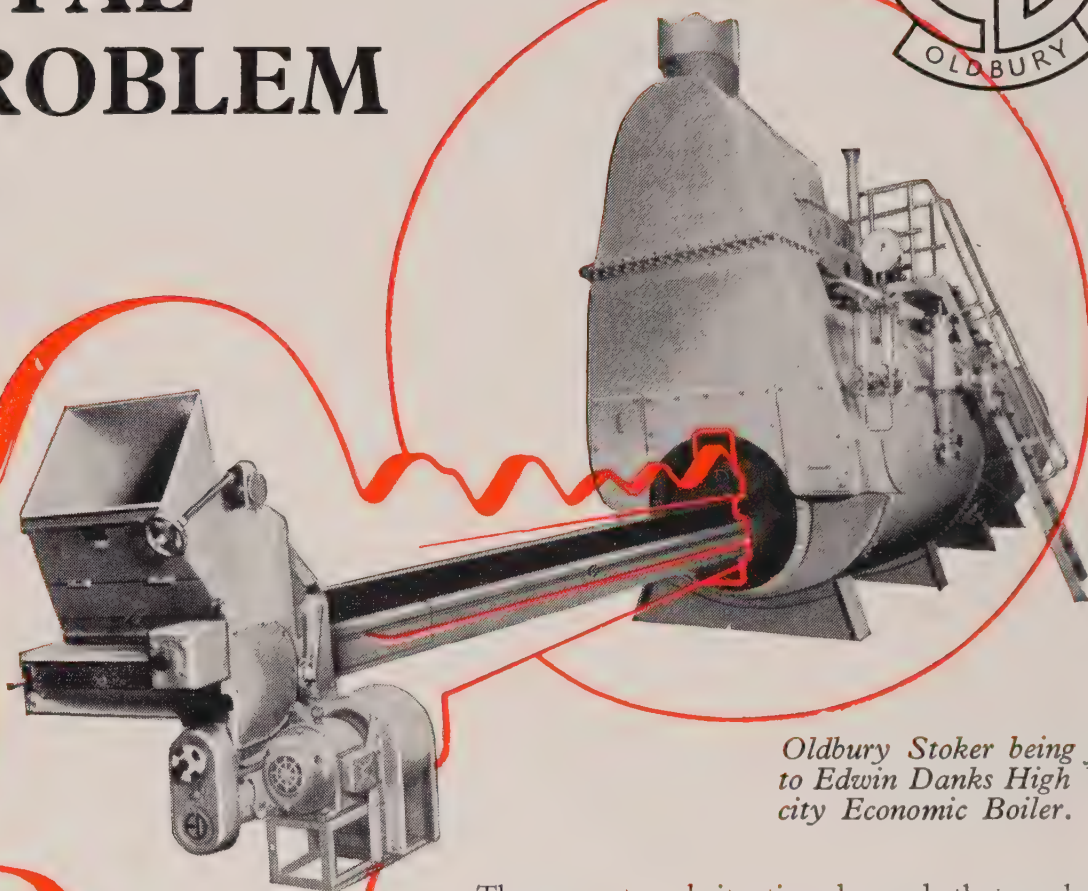
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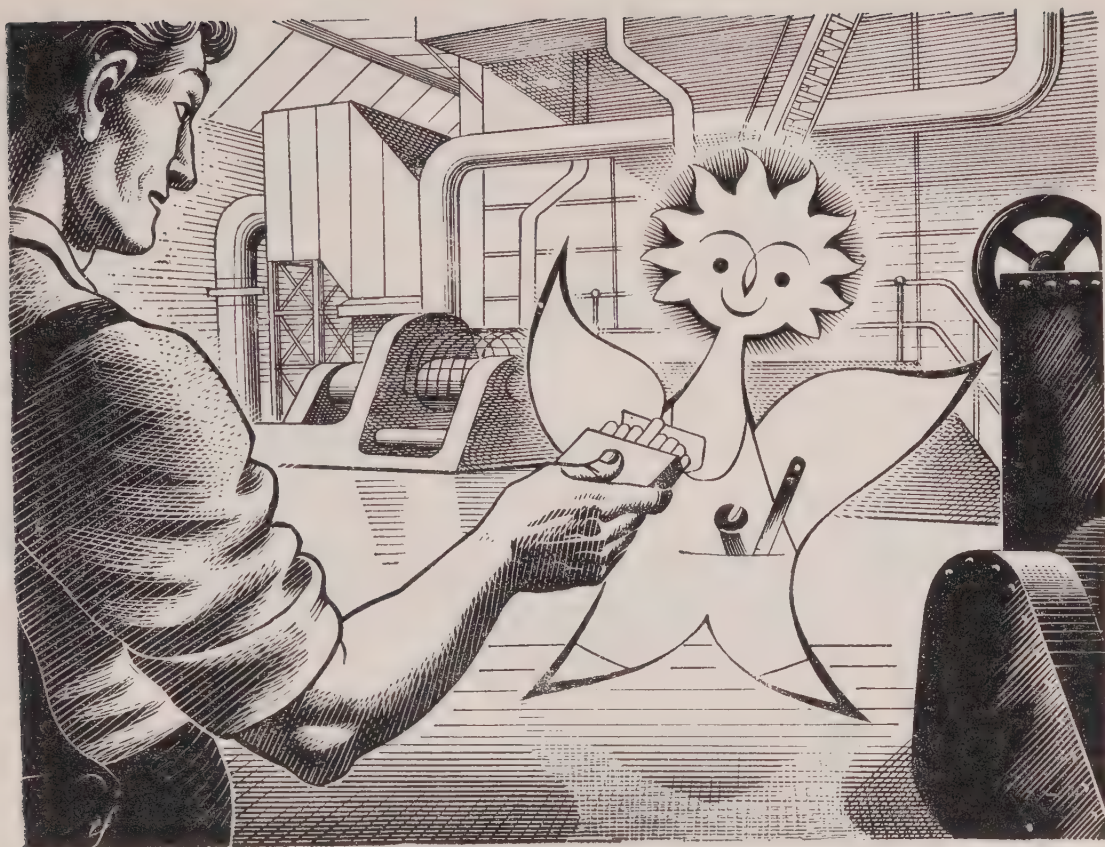
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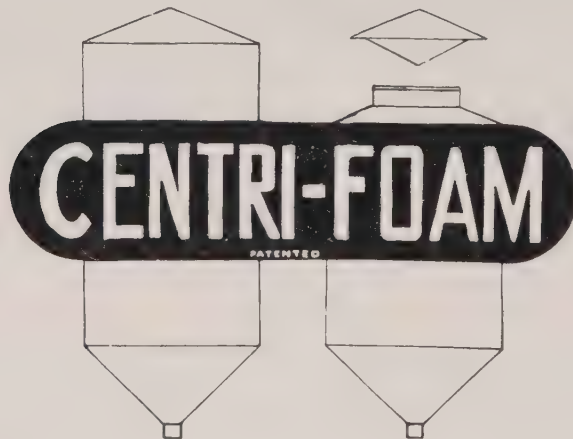
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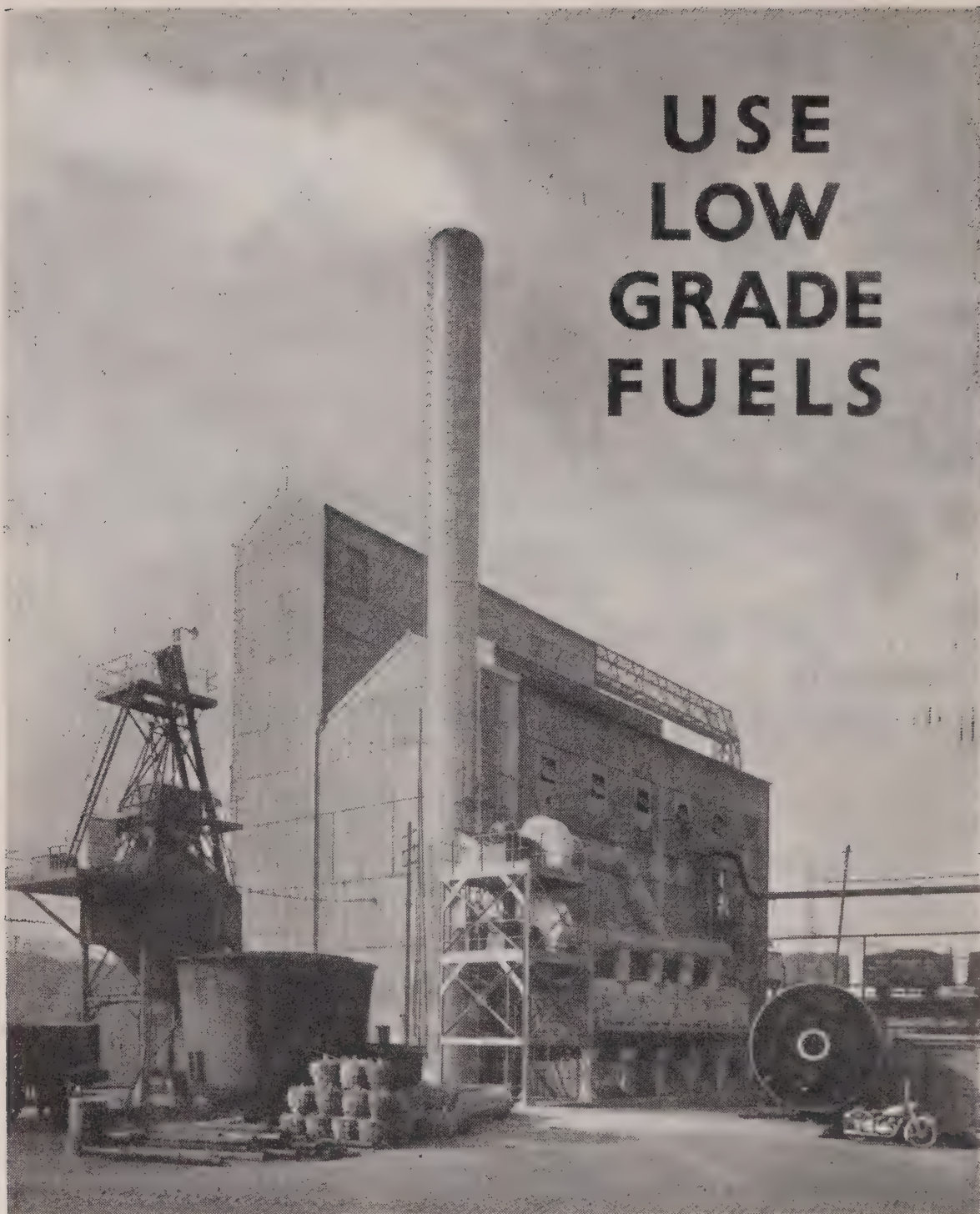
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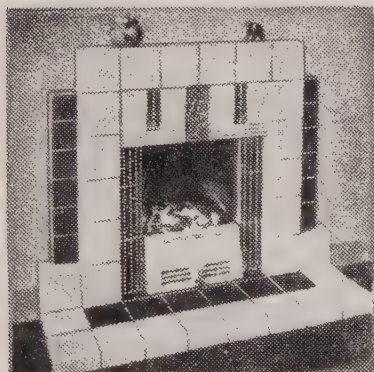
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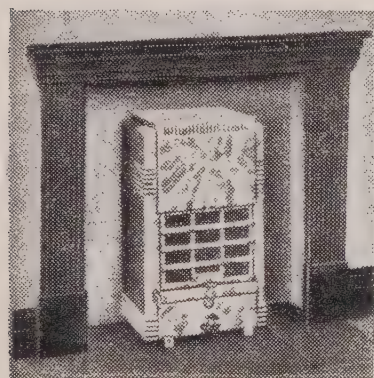
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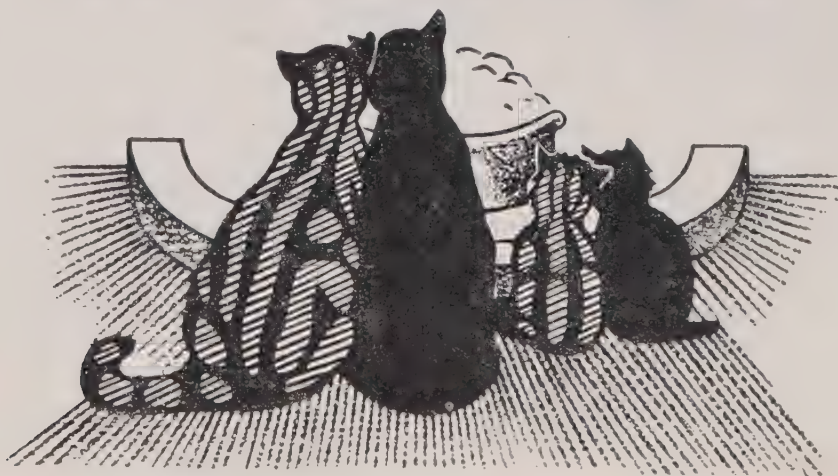
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SMOKELESS AIR

Vol. XXII. No. 81

Spring, 1952

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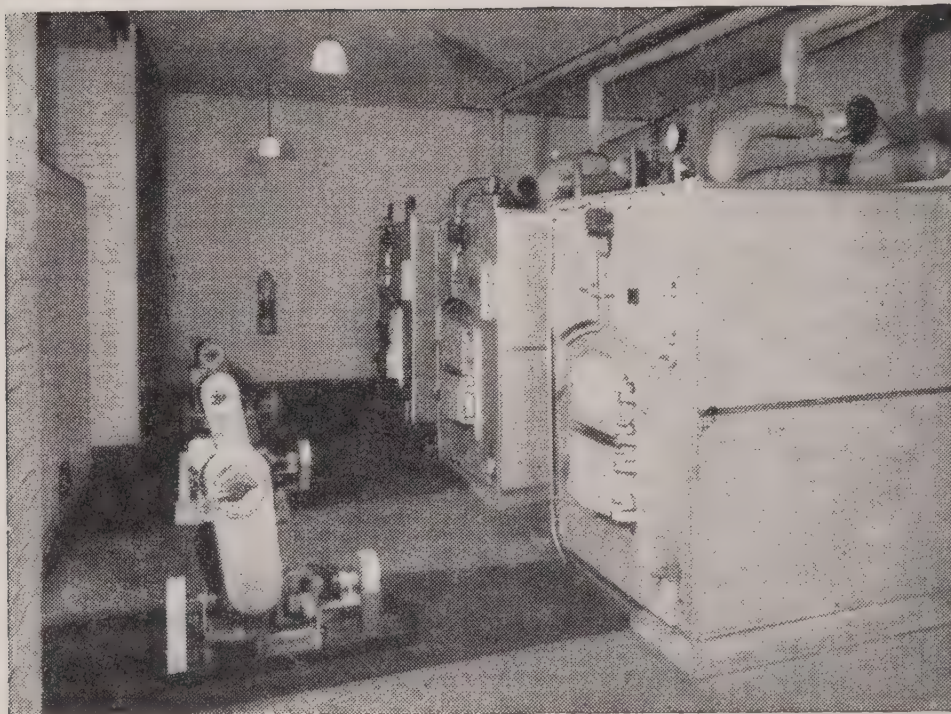
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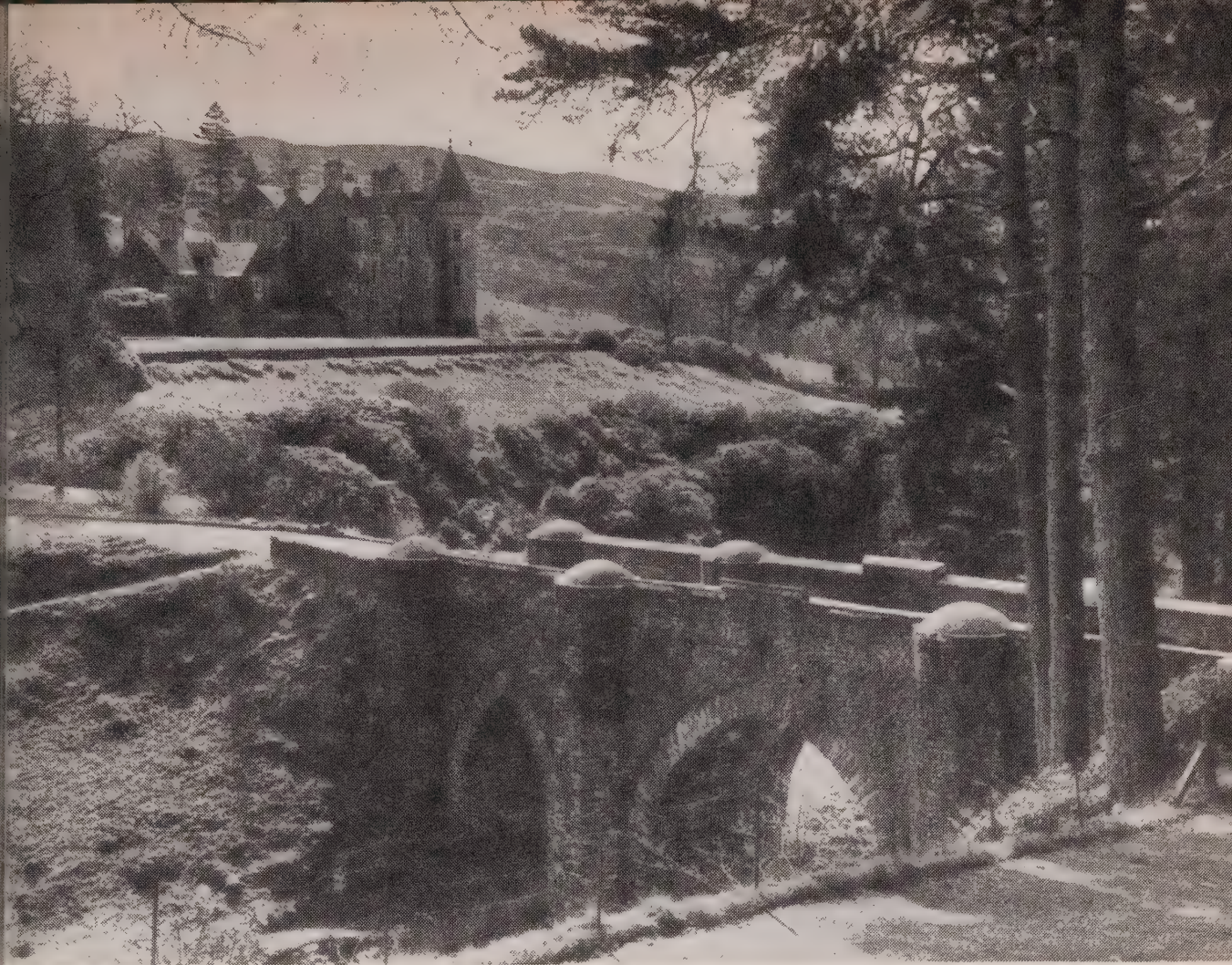
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air*

SMOKELESS AIR

On behalf of the members of the Society we record our sorrow at the death of His Majesty King George VI, and our sympathy with the members of his family. We offer to our new Queen, Elizabeth, the loyalty and good wishes of a body of her subjects whose special purpose it is to improve and safeguard the purity of the air, promoting thereby the health and well-being of her people, and restoring the natural lustre of the precious jewel that is Her Majesty's realm.

The "Inflation Appeal"

We are grateful to the many members who have responded to the recent appeal for an increase in subscriptions

to help the Society to meet the seriously increased costs it has to bear. Since subscriptions fall due throughout the year it is not yet possible to say what the full effect will be, but it is already evident that the request has, generally speaking, been received as we had hoped. We can assure members that efforts are also being made to gain new support to make possible not only the maintenance of our work but its expansion.

The Hardy Briton

On a recent journey north we talked about the coldness of the winter with another traveller, a business man from the north-east coast. Shrewd and

hard-headed though he probably was in his business life, he amazed us when he said—with a touch of pride, it seemed, as of proof at his fortitude—that during the previous week the temperature one night in his dining room had fallen to 16° F. below freezing point. He admitted that he ought to do something about it, but he didn't care for central heating. We reflected sadly on the amount of fuel that has to be used in such cases even to bring the temperature back to a bearable level, and on the excessive amount of smoke that would be poured out during this process.

A Different Story

Compare this state of affairs with the account told us of the combined effect of installing an openable stove in the living room of an average sort of house, and insulating the loft space with a good layer of slagwool or glass silk. The stove, though it was kept burning continuously, was nearly always kept closed and burned far less fuel than the open fire it had replaced. At night the downstairs doors were kept open so that warm air could diffuse out into the hall, into the dining room, and up the stairs. The fabric of the house was kept warm and dry and throughout the winter the hall temperature did not fall below 50° F. even with an outside temperature down to 21° F. "And what's more," said our enthusiastic friend, "the family often forget to switch on the electric fire in the dining room for breakfast, or are content with one bar instead of two, while the reduced demand for hot water bottles at bedtime is saving no end of gas."

He made the point that while we heard a great deal about the thermal efficiencies of different appliances and systems, such figures meant little unless they took account of the secondary savings in fuel and power such as those he had observed.

Local Consultative Committees

We gather that a recent article in this journal about the local consulta-

tive committees for smoke abatement set up in Widnes, Burnley, and St. Helens, has helped towards the formation of two more such committees, again in Lancashire. They are for Rochdale and Nelson. In both cases the committee consists of representatives of the local authority industrial and commercial interests, trade unions, government departments and women's organizations. At Rochdale Dr. John Innes, Medical Officer of Health, has been appointed Honorary Secretary. The Nelson Committee (which also covers Brierfield and Barrowford) has appointed Alderman Bland as Chairman and Mr. W. L. Kay, Senior Smoke Inspector, as Honorary Secretary.

We wish every success to the new organizations, and once again ask other local authorities to note these developments.

1952 Conference

Preparations for the next annual conference of the Society are now being made. It will be held by invitation of the Lord Mayor and Corporation in one of the most interesting of all our cities—Portsmouth. The dates are September 24th to 26th. Details of the programme will be announced later, but it can already be said that for the third Des Voeux Memorial Lecture we shall be leaving fuel and science to consider, in its broader aspects, the Law. The lecturer will be Mr. W. R. Hornby Steer, who is Recorder for South Molton, a member of the London County Council, Standing Counsel to the Society, and, of course, author of our well-known handbook on the *Law of Smoke Nuisances*.

By Any Other Name

As no comments have been received from readers on the letter published in our last issue about changing the name of the Society, it can only be assumed that the general view is that it does not much matter. There was, however, one amusing press comment, prefaced by a pleasing compliment to this

journal which was described as "a model among organs of its kind . . . well-produced, easily read, and full of topical interest."

G.A.S.P.S.

This was in the *Gas Journal*, which went on to discuss the pitfalls in the way of any change of the Society's name, as follows :

"Another matter which receives attention in this issue is the suggestion from certain quarters that the Society should change its name. There is, apparently, objection to the narrowness of 'smoke' and to the weakness of 'abatement'—but against this there is the familiarity of the phrase 'smoke abatement.' A decision to change one's name is not one to be taken lightly in any walk of life, and we wonder what the exponents of change would recommend by way of improvement. One school of thought, we gather, considers the name should include all atmospheric pollution ; but at all costs the Society must guard against a title which produces any of those lamentable abbreviations common to some of our existing professional and other bodies. For example, while the Society for the Abatement of Atmospheric Pollution might fill the bill, the abbreviation S.A.A.P. leaves much to be desired. A correspondent points out that under section 110 (1) of the Public Health Act, 1936, smoke is defined as 'soot, ash, grit and gritty particles,' but does not include dust not emitted from chimneys as an ingredient of smoke. The all-embracing title of Society for the Abatement of Dust, Soot, Ash, and Grit strikes us as just a little cumbersome, while the abbreviation S.A.D.S.A.G. is unfortunate. Shorter and more forceful, perhaps, is S.A.G.A. (Society for the Abatement of Grit and Ash), but less pleasing, and definitely out of keeping with the objects of the Society, is the re-arrangement to provide G.A.S.P.S. (Grit, Ash and

Soot Prevention Society). Alteration is not always improvement, as the pigeon said when it got out of the net into the pie, and for our part we rest content with the comparatively euphonious N.S.A.S."

Year Book, 1952

The Society's *Year Book* for 1952 is being published at the same time as this journal, and will be received by all members and representatives. Other readers who wish to have a copy may obtain one on request. The *Year Book*, in addition to the Society's annual report, accounts, subscription list, etc., contains a section of useful information on smoke prevention—the law, other organizations, bibliography of recent papers, classified list of publications, etc.

The White Country?

Progress in smoke prevention in the Potteries is shown by the fact that on two occasions recently the air was found to be too clear to enable scenes representing conditions in the last century to be filmed satisfactorily. The Stoke-on-Trent fire brigade were called upon for artificial smoke, and canisters burning smoke-producing materials offered a suitable, if unpleasant, atmosphere.

Correction

A printing error in the report of the lecture by Dr. Bronowski, "Power and Waste in their Social Setting," as printed in our last issue and in the Blackpool Conference Proceedings, made meaningless an important sentence. The last sentence of the third paragraph after the sub-heading "Method not Technique" (SMOKELESS AIR, p. 61 ; Proceedings, p. 10) should read thus :

"And we still waste in damage to health and buildings between one and two per cent. of our national income each year, which is as much as we have recently spent on building new houses."

Smokeless Fuel in Britain

by G. E. Foxwell, D.Sc.

Dr. Foxwell, a foremost authority on coal carbonization, and President of the Institute of Fuel, has been good enough to write the following critical review of the series of articles on the solid smokeless fuels that have been published in recent numbers. It is open for discussion if any readers find it too provocative.

THE Editor of *Smokeless Air* is to be congratulated on his initiative in publishing a series of five authoritative articles on the types of solid smokeless fuels produced in Britain. In these articles, the spokesmen for the manufacturers of these fuels have put their goods in the shop window. It is no discredit to the authors that they have each made the best of their wares. "Come ye, buy—and burn," they say in effect, so that the uninitiated might well consider that there is no longer a smokeless fuel problem in Britain. Doubtless it is for that reason that the Editor has demanded a summing-up of the position. This summing-up cannot be judicial in relying for its facts upon the evidence presented, since the Counsel for the Prosecution has not been heard. In these five articles, producers of smokeless fuels—and of *solid* smokeless fuels only—have stated their case. They have shown that they produce smokeless fuels, a contention which no one will deny, but have not considered whether their contribution to the national problem is adequate. They have maintained without any exception that their products are suitable for the purpose for which they are required, but Counsel for the Prosecution may well have had something to say on that score. This summing-up will therefore take known adverse criticisms into account. It will inevitably be provocative but, it is hoped, judicially fair.

The age-old pattern of private enterprise has always been based on the supply of goods for which there is public demand, or for which a public demand can be created, at such prices

as will yield a satisfactory profit. The pattern has changed within our lifetime. The gas and electricity supply industries have for many years taken the attitude that their objective is to serve the public. The late Government accepted that view and made them—and the coal industry—into public servants. The political aspects of this transformation do not concern us. What seems clear is that the fuel industries of the country now exist to supply public demands, when reasonable, and at a cost which will give the service required without creating financial loss to the industries involved. The fuel industries are not now concerned, therefore, with asking of any new development, will it pay? but with asking if the public demand is sound and reasonable, if it is in the national interest, and if it can be met without loss to themselves at a price that the public can afford and will pay.

There is no industrial problem of smokeless fuels. With perhaps very few exceptions raw bituminous coal can be used in industry without emission of smoke in significant amounts by applying the known, and generally elementary, principles of fuel technology. Gas and electricity are justifiably preferred in many industrial operations to solid fuel, and coke is often preferred to bituminous coal. The real problem is that of domestic fuel supply.

In the domestic field, we are faced with a long tradition of burning raw coal. Tradition dies hard and it will only die if the modern alternative is better than the traditional practice. No one will deny that a national policy of smoke abolition would be of

immense value in health, financial saving and in man-power to the nation. The individual, however, asks whether the means provided are as convenient as his traditional practice. It is the individual whom we must convince; and it is no use flinging laboratory figures and test-bench efficiencies at him if he finds the new methods are not as convenient as the traditional coal fire. Sometimes the vendors of existing high-temperature cokes seem to forget this truth.

But tradition is also based upon use and habit. To destroy the habit of our traditional methods we must show that the newer system is better. Where has tradition led us? A passage from the report of the Ministry of Fuel and Power on "District Heating in American Houses," which is paralleled in other recent documents, may serve as the answer: "Before the war the average family burned each year about $4\frac{1}{2}$ tons of raw coal alone with an efficiency no greater than 20 per cent. As a return for this outlay we acquired an international reputation for having the coldest houses in the civilized world, which in effective living space were confined in winter to small semi-circles round the fire."

The seriousness of our coal problem is now understood by everyone. It is clear that not only for the next year or two but probably for decades to come we shall be short of fuel. We shall not produce the quantity of coal that will be necessary if the nation is to maintain the standard of industrial productivity upon which we shall depend to secure our present standard of living. We cannot therefore increase the warmth in our houses or increase the size of the semi-circle round the fire in which we live during the winter months unless we also increase the efficiency with which fuel is used. Much can no doubt be done by improved appliances and improved methods of heating but it is very largely to the housing authorities that we must look for assistance in this matter. Our smokeless fuel problem is not one only for the fuel technologist or the fuel industry.

Faced with rising costs of construction, housing authorities have cut down on Egerton standards for insulation. There are new systems, such as whole-house heating, in which the whole house can be heated to 50°F. and the living rooms to 65°F. with an expenditure no greater than the $4\frac{1}{2}$ tons of coal a year on which hitherto we have allowed ourselves to freeze. In this aspect of the problem, therefore, we must rely upon the co-operation of the housing authorities and of architects and hope that they will realize that the expenditure of a little more in capital cost is well worth it in order to get increased comfort or to save fuel.

We are today faced with the demand for greater comfort, but at the same time we are faced with the rising cost of fuel, the shortage of fuel, and the rising cost of construction. Those are the problems that must be met by the housing authorities, both in the design of the houses, including adequate insulation, and of the installation of more efficient methods of heating, including appliances. We are also faced with the demand for less household labour because women demand more leisure and so many women now go out to work.

If then, quite a sizable slice of the domestic heating problem must be remitted to the housing authorities and the architect, a second sizeable slice must be remitted to the producers of appliances. Considerable strides have been made in the design of appliances which bring the primary and secondary air supplies within control and avoid the use of excessive quantities of air which are warmed by the fire and pass up the chimney. These appliances are also fitted with sufficient insulation to enable the fire to be burnt down to quite low limits if—and the qualification is important—coke of adequate quality is supplied. The use of approved appliances is a valuable step forward. The City Editor of an important newspaper writing on December 9th, reported: "A £10,000,000 boom in new types of fuel-saving coal fires brings joy to



Dr. G. E. Foxwell

the big foundry companies. . . . Some firms are eight months behind in deliveries. Present demand is estimated at 60,000 a week." If production could be anything like the rate of 60,000 a week and this were kept up for, say, 5 years, it can be calculated that most of the country would be equipped with efficient solid fuel appliances.

There are, however, two snags in this. The first is whether the appliances are in fact efficient. Rising costs lead to a demand on the part of housing authorities and private purchasers for cheaper appliances. In order to cheapen appliances workmanship suffers. Personal experience has shown that arrangements said to enable the appliance to be shut down to very low combustion rates may contain so many sources of air ingress through badly fitting damper and other arrangements, particularly below the fire-grate, that in point of fact there is no control whatever. This does not apply, of course, to all appliances but it is a matter to which attention should be paid. Air control arrangements should fit tightly, not work loose, and the surfaces should be machined in order to avoid leakage.

The second difficulty is that appliances that can be used for smokeless fuel can also be used for burning bituminous coal and in too many instances they are used for that pur-

pose. It is difficult to know what is the solution to this problem other than compulsion in some form or other, which would be distasteful. We have had quite enough of compulsion during the past ten or fifteen years to serve us for many generations to come. Probably the permanent solution is to produce a fuel as good as coal in sufficient quantities.

The demand for labour-saving fuels is fulfilled primarily by the use of gas or electricity for heating purposes. There are many reasons why under present economic conditions electricity should not be used for space heating. Public expression has been given to those reasons on many occasions recently but the only one that need be mentioned here is that of the load factor. There is a shortage of electricity and we require electricity for power purposes in order to speed production. It is admitted that there are conditions under which it is necessary to use electricity for space heating, for water heating or for cooking, but if the true cost in money and fuel is debited to electricity supplied for these purposes it will generally be found to be uneconomic and not in the national interest.

This argument applies also in lesser degree to the use of gas for space heating. Gas is the ideal fuel for cooking all the year round and water heating in the summer. Both of these services are required generally only for short periods each day. Through the gasholder the gas industry can level out the load factor so that it is well equipped to take these loads. The difference here is that electricity cannot be stored whereas gas can be stored economically for short periods.

Gas is, however, not well suited for domestic space heating since here the load factor comes into account. As the weather becomes colder more heating plant is brought into action; since very cold weather lasting more than a day or two, involving a load capable of being supplied by gas storage holders, only occurs at long intervals (about once in every two or three years in the south), it follows that

some gas-making capacity for space heating will be idle most of its time. The load factor of space heating is never very good and is often very bad. Some figures indicating this are given below. They put the position at its worst since they do not include the use of carburetted water gas which involves very much less capital cost than carbonizing plant. The figures below illustrate the principle, however, and show that it is to the advantage of the gas industry to remain a two-fuel industry, since only in that way can smokeless fuel be provided by it that can be stored for any length of time, and that will supply the winter space heating load, whatever its load factor.

cheap for general use that will be smokeless when burning bituminous coal. We have therefore to make up our minds at this stage whether we shall be satisfied with smoke abatement, burning raw coal with the minimum of smoke, or whether we shall work for smoke abolition, which can only be achieved by using smokeless coals for domestic space heating.

This is a problem in economics. The fact of the case is that the fuel industries, though urged to do so in the Simon report, have not yet started to produce sufficient smokeless fuel to replace raw bituminous coal. In normal circumstances, the task could have been accomplished within a

<i>Atmos. temp. Daily average</i>	<i>Load factor</i>	<i>Proportion of the carb. plant to supply gas at this load factor in London</i>	<i>Capital charges on carb. plant</i>	
			<i>at 7s. ton coal carb.</i>	<i>Effect on capi- tal charges on gas as each category is added</i>
°F.	%	%	d/therm	d/therm
Base load	100	35	1	1
65-41	44	28	2.3	1.6
41-32	5	15.5	20	5.1
32-20	0.25	21.5	400	90

The conclusion is thus reached that it is unlikely that in this country, where we rely on manufactured gas (it would not apply where liquified petroleum gases are used), that we can be supplied for generations to come with fuel for space heating that requires only the turn of a tap or a switch. Our objective must, therefore, be to devise methods of dealing with ash (the first step here being taken at the colliery), dust and smoke arising from solid fuels that will involve the bare minimum of labour and dirt. When the washery has done its job, the rest is largely an appliance design problem. It is in the last degree unlikely that we can ever devise a solid fuel domestic space heating appliance

reasonable time. The present writer examined this problem with the expert advice of the authorities concerned immediately after the war (J. Inst. Fuel, XIX, 102) and reached the conclusion that if all those concerned played their part—the gas industry, the coke oven industry and other carbonising interests, and the mining industry in expanding the production of smokeless coals, the housing authorities in providing houses insulated to Egerton standards, the appliance manufacturers in providing more efficient appliances—sufficient smokeless fuel could be made available within a very few years not only to replace raw bituminous coal by solid smokeless fuels, but to give the improved stan-

dard of heating envisaged in the Egerton report. Under pre-war conditions, that happy state could have been reached by now, i.e., within the period 1946-52.

No one foresaw, however, the economic and political aftermath of the late war. No one could foresee yet another re-armament programme. We could have foreseen, but most of us did not, the need for straining every effort to export to the limit of what overseas markets could absorb. The significant fact is that construction of new plant is very slow compared with pre-war conditions, and that any additional coal that can be produced by the mining industry is needed for purposes other than domestic heating. The Egerton standards of comfort *in existing houses* have been removed from our reach by stark economic necessity. Instead of the revolution in domestic heating that many hoped for, we must be content now to settle down to the graduality of evolution. That does not absolve the fuel industries from doing whatever is possible. The National Coal Board is the source of raw bituminous coal ; it may fairly be asked to replace it by solid smokeless fuel in increasing quantities. If the gas industry remains a two-fuel industry, it too will have a most important part to play in this development. If it decides that its future lies in total gasification, the supply of solid fuel must devolve almost wholly on the N.C.B. The physical impossibility of providing sufficient solid smokeless fuel under present conditions forces upon us the choice, for at least 20 years to come, of smoke abatement rather than abolition, of using bituminous coal relatively smokelessly rather than of changing to smokeless fuels.

The policy of graduality is probably best for us in the long run. Hasty methods are seldom the best, and time will be given for developing sound fuel policies, for designing better appliances, for finding better ways of building houses that are destined to be lived in comfortably in our damp and rheumatic climate. We may with

confidence look forward to a steady increase in our smokeless fuel output and to a steady abatement in the quantity of raw coal used ; this will come about only if we continue to work steadily in that direction.

The part to be played by housing authorities and by appliance makers has been indicated. It has also been pointed out that the manufacturers of solid fuels have a duty to increase production as fast as the economic condition of the country permits. Undoubtedly it would be in the national interest to replace raw coal by smokeless coals—but that is another theme which cannot be pursued here. It has also been pointed out that we must pursue a policy of evolution, and as a part of that policy, tradition must be broken down by providing the domestic consumer with a fuel and a service that will persuade him of his own volition to adopt smokeless fuels and the newer methods of heating.

From this survey there arises the question how far we fall short of the ideal. In what do we fail to provide the necessary service ? Many of the answers to that question have been given earlier in this summing-up. One more remains to be given. Counsel for the Prosecution, had he been called upon, would have declared that there is too much complacency in the solid smokeless fuel industries on the quality of their product. No one would deny the efficacy of certain fuels, fuels produced at a temperature below that of the gas retort or coke oven, or fuels made by careful blending of suitable coals. But a high authority, who would be quoted by Counsel, has made this categorical accusation : “ The coke produced in a considerable proportion of the gas-making plant in this country is not sufficiently flexible as a fuel for modern domestic appliances. It is difficult to ignite and once ignited a high rate of combustion must be maintained. It is difficult to maintain the slow rate of combustion required for overnight operation. Continuous vertical retorts give a more reactive and hence more flexible

fuel but the low density of the product makes it difficult to get sufficient weight of fuel into the appliance for overnight combustion" (Coke, and Gas, March, 1952). The same criticism applies to much oven coke. Only those who have had experience of burning coke in a domestic grate know the difficulties that result from a too-difficultly-ignited coke. The writer may quote a case recently in which a delivery of gas coke refused to ignite in a modern closed stove after being heated by a gas poker for a full hour. This was not an isolated instance; it happened day after day until that delivery of coke was used. The plain fact is that in quality of coke and design of appliances, we have yet some way to go before arriving at a condition in which any delivery of coke will behave satisfactorily on even a modern grate. The solution of this problem is only partly technical; the technical aspects of it have been pretty well investigated. It is largely one of economics. More reactive coke costs more to produce for a variety of reasons. Better appliances cost more money. Have we yet educated the consumer to be prepared to pay more a ton for a fuel that will serve him better? Have we yet persuaded him that intangible benefits, such as reduction of smoke, dirt, and better heating, are worth the extra money? Does he,

in the mass, yet realize that solid smokeless fuels give a higher proportion of useful heat per ton of fuel than raw bituminous coal?

There is still much work to be done both on the technical side and on the educational side before our problem is solved. There is still much to be done in increasing supplies. There is no room for the complacency which ran like a thread through too many of the Reviews. This in no way overlooks the immense amount of work that has been done by all the fuel industries and by the Fuel Research Station on this problem. It is work that has been well worthwhile and that has enabled a large measure of success to be achieved.

Nevertheless, the verdict must be GUILTY. The Housing Authorities are guilty of not building properly insulated houses that will conserve fuel and increase comfort. The Appliance Manufacturers are in a lesser degree guilty of not yet achieving the standards of workmanship. The Fuel Industries are guilty of not producing sufficient solid smokeless fuel and of producing far too much that is unsuitable. There are exceptions in every case, and many appeals against this judgment would be successful.

The Sentence? Hard Labour for all concerned until this problem be satisfactorily solved.

The John S. Owens prize offered by the Royal Sanitary Institute each year for a paper on atmospheric pollution or ventilation has for its subject this year "The Ventilation of Buildings used for Industrial Processes giving rise to Noxious or Unpleasant Dusts and Fumes, and the Prevention of Atmospheric Pollution by such Dusts or Fumes." The prize is £15, and essays must be delivered on or before December 31st, 1952. Details from the R.S.I. at 90 Buckingham Palace Road, London, S.W.1.

Many of our readers will be interested in a reprint of a series of lectures by Sidney Webb on "The Evolution of Local Government," which appeared originally in the *Municipal Journal* in 1899. An understanding of our local government system must be based on knowledge of its history and development, and no one was better fitted than Sidney Webb to provide this background. (Published by Municipal Journal Ltd., 3-4 Clements Inn, London, W.C.2., at 3s. 6d.).

NATIONAL FUEL POLICY

Memorandum from the Society

The following memorandum has been submitted, on behalf of the Executive Council, to the Committee on National Fuel Policy, of which the Chairman is Viscount Ridley, C.B.E. The Committee was set up by the former Minister of Fuel and Power, Mr. Noel-Baker, "to consider whether any further steps can be taken to promote the best use of our fuel and power resources, having regard to present and prospective requirements and in the light of technical developments.

1. Introductory

Because smoke is one of the consequences of the inefficient use of coal the National Smoke Abatement Society has always sought to promote measures for the better utilization of fuel. The Society is perhaps the oldest organization working towards this end. Although, in the main, its policies are of a long-term nature, the observations that follow are confined to matters of immediate concern.

They may be prefaced by expressing the hope that in the framing of any statement on fuel policy, due weight will be given to the social costs resulting from the use, or misuse, of fuel. The most serious and extensive of these costs is that due to the emission of smoke, and this should be included as a factor in any review, from a national viewpoint, of the economics of a fuel policy.

Although the cost of smoke in terms of health and well-being remains the first reason for seeking its prevention, the material damage it does is of major importance, especially at the present time. There is extensive damage to buildings, metals, fabrics, and property of all kinds; added costs and lower yields in agriculture; hindrance to and more hazard in flying; and substantial diversion of labour and materials from production to maintenance. These factors, added to the loss of fuel involved, suggest that

smoke prevention may be one of the largest single economies open to the nation.

Preceding all other considerations, however, is the primary need to secure the proper integration of all our fuel and power resources and means of utilization.

2. Domestic Fuel Economy

Appliances. We would urge adherence to the recommendations of the Fuel and Power Advisory Committee, despite the difficulties that prevent the early implementation of some of them. In particular we urge not only a continuation of the policy of requiring new houses to be fitted with improved types of solid fuel burning appliances, but action to prevent the continued manufacture or sale of obsolete grates and ranges.

The simpler forms of improved grate represent an advance over the ordinary stool bottom grate by virtue of their greater control over combustion rate (and with suitable fuels make possible general domestic smoke prevention). Bearing in mind the continuing shortages of fuel, imposed on the user by either financial or supply considerations, and at the same time the maintenance of a satisfactory standard of heating, such appliances are only a half-way stage to the economies that are possible with really efficient types. Action should, therefore, be considered for encouraging the installation of closable stoves and other convector fires giving high efficiency, particularly with bituminous coal, which will remain the principal fuel supply for many years to come. The additional constructional material required for these and other more efficient appliances is negligible compared with the fuel which could be saved by them during their lifetime.

The production of simpler forms of stoves and convector fires for existing houses which could be made more

quickly, and at less cost, has been suggested, and should be investigated.

3. Industrial Fuel Economy

(a) *New Installations.* For smoke abatement reasons the Society has proposed what is called the prior approval of new industrial fuel burning installations. Powers for this purpose have been obtained by a number of local authorities in recent local Acts, and in other instances a voluntary form of prior approval is being worked by the co-operation of different departments of an authority.

The value of examining and frequently advising on plans for new installations is particularly important in the case of smaller industrial concerns without the services of experienced fuel technologists. The installation of unsuitable or inadequate plant can lead not merely to smoke emission, but to other substantial fuel losses, and the principle of prior approval is therefore as important for fuel saving as for smoke abatement. So far, however, it is operating in this country in a few of the larger towns only. (The principle has been widely adopted, and accepted, in the U.S.A., Canada and elsewhere).

It is therefore urged that consideration be given to ways and means—preferably by voluntary arrangements in the first place—for ensuring that proposals for all new industrial and commercial fuel-burning installations that come to the notice of a local authority or planning authority are examined on grounds of fuel efficiency and smoke abatement, by a suitably qualified officer of the local authority, or at the request of a local authority by a fuel efficiency engineer of the Ministry of Fuel and Power, or by an area advisory panel.

The Society is prepared to discuss this proposal in greater detail.

(b) *Education.* The importance of training and improving the status of boiler-house attendants and furnace-men has been advocated by the Society for many years. A more vigorous national policy for this is urgently required and should be pur-

sued. The Society is in particular anxious to see (a) extension of facilities for classes, with which must be coupled incentives for attendance, (b) a higher elementary or intermediate certificate of proficiency of a national character, and (c) steps leading ultimately to the registration of all firemen.

4. Incentives

The cost to the nation of continuing to waste its fuel resources, together with the losses arising from shortages of supply, etc., are so vast that financial incentives, subsidies, and other means to accelerate desirable changes, can be considered on a broad and generous scale for both industrial and domestic installations. There is for instance a strong case for subsidizing the installation of improved appliances in the home, including replacements of existing appliances under approved conditions. The principle of smokeless zones, now beginning to be applied, may be cited as a means for progressive, and at first even experimental, advance in this direction. Rating and taxation incentives and deterrents to promote the use of fuels to the best national advantage should be considered.

Further, it would be appropriate to consider how the production of the solid smokeless fuels may be assisted or stimulated. In the opinion of the National Smoke Abatement Society the new coal price structure now being considered provides an opportunity for encouraging the production of solid smokeless fuels by establishing a more logical relationship between the cost of coals used for industrial, carbonization, and domestic purposes.

5. Long Term Policy

Although this memorandum has dealt only with a few matters about which something can be done, or begun, at once, it is emphasized that in our opinion a long-term general fuel policy should be drawn up, even if only in outline. Otherwise, it is feared, it may well be that expedients devised for the moment will lead to new problems and difficulties.

The Conference Resolutions

Widespread Interest

AT the Society's Blackpool conference in September last the following resolutions were moved on behalf of the Executive Council and were unanimously agreed:

1. THAT this conference of the National Smoke Abatement Society expresses appreciation of the action of the Government in ensuring that approved fuel-burning appliances only are installed in houses built either by local authorities or by private builders under licence, and, as a further step towards fuel saving and smoke abatement, the Conference urges the prohibition or active discouragement of the manufacture and sale of appliances that do not meet minimum standards of efficiency. Further, whereas the increase in value of premises is normally followed by increased assessment, the fuel situation is so serious that the Conference urges that the modernization of heating equipment should be treated exceptionally and urges that, on the contrary, financial or other inducements should be given to obtain this end.

2. THAT this Conference urges all local authorities and industrial firms and associations to promote smoke abatement and fuel efficiency by assisting in and encouraging the organization of classes for boiler and furnace men and attendance at them of the men concerned.

3. THAT this Conference invites Chambers of Commerce and other business and industrial associations to consider the cost and waste to trade and industry caused by air pollution, and asks them to bring this to the notice of their members with a view to greater co-operation for the prevention of pollution with local authorities and the Society and its Divisions. The Conference records its appreciation of a recent resolution of the National Union of Manufacturers that calls for economy

in the use of fuel, further research, and the extended use of smokeless fuels.

Replies to the First Resolution.

The resolutions were subsequently submitted to all local authorities in Great Britain, and the third has also been submitted to Chambers of Commerce and of Trade.

The attention given to the resolutions by local authorities has been most gratifying, both for the publicity given to smoke abatement in general and for the attention directed to the particular points raised in the resolutions.

Letters commenting in some way or other on the resolutions have been received to date from well over 300 local authorities, and are still coming in. It is not easy to summarize these letters so as to make clear the consensus of opinion, but the following partial analysis gives some idea of this.

Over 200, or two-thirds, of the replying authorities gave their support to the first resolution, although 21 of these did not agree that financial inducements should be given to achieve the modernization of heating equipment. Twenty-eight authorities said they would not support the resolution.

Four authorities thought that unless smokeless fuels were available at a reasonable price and in more variety there was no object in installing improved appliances.

Seven authorities considered that the support of the associations of local authorities should be sought or that the associations themselves should make representations to the Government to prohibit or actively discourage the manufacture and sale of inefficient appliances.

Unexpected points of view were expressed: such as the local authority in a mining area that wanted the N.C.B. to put in approved appliances

in houses owned by them, and another mining town which didn't want this done. In another case it was thought that it might be necessary to forego improved appliances for reasons of economy, and in yet another there were doubts about whether there was in fact any economy in using coal to make steel for fuel economy appliances !

The Public Health Committee of one of the principal City Corporations recommended that a further resolution be added, namely :

“ THAT the Government should take steps to ensure that in regard to domestic fuel, priority is given to the supply of smokeless fuels and boiler fuels, so encouraging the installation of modern fuel-saving and smoke-eliminating heating equipment and placing the user of soft coal in an old-fashioned grate at a relative disadvantage.”

Classes for Boiler and Furnace Men

This resolution was supported by 173 local authorities, 37 of which added information about classes already in progress or being arranged. One R.D.C. decided to circularize factory owners asking them to encourage employees to attend classes which, at the same time, it urged the local technical college to inaugurate.

Three local authorities mentioned the difficulties in promoting classes, including men's reluctance to attend because of written work, and the reluctance of employers to give financial reward to the holders of certificates, because of the discrimination that would then have to be exercised among men on the same work. They felt that the difficulties might be overcome if the classes were arranged by local education authorities in co-operation with employers.

It was also suggested that in a district where the number of industries was relatively small the training should be done at county level. Other authorities described how the training had been arranged, including classes organized by local industries, works' visits, and film shows. One city

supports the policy by making a grant of £5 to each of their own employees who completes the three years' course and examination.

Chambers of Commerce

The third resolution arises largely from a resolution *to* the Society passed towards the end of 1950 by the Manchester Health Committee. This urged the Society to circularize firms and commercial undertakings about the smoke nuisance and to ask them to abate their own emissions. Although the value of a direct approach in this way was recognized, it was quickly seen that such a mass circularization was far beyond the limited resources of the Society, and that to be effective such an appeal would have to be reiterated in other ways. To approach instead the associations of firms in trade and commerce was, however, seen to be feasible, and this led to the framing of the resolution.

(This action, incidentally, is an excellent example of the general way in which the Society can best work. Lacking the wealth needed for mass persuasion, it can most profitably seek to interest representative bodies who in turn can reach their individual members.)

The resolution was sent to local authorities for information as well as to all Chambers of Commerce affiliated to the National Association of Chambers of Commerce, and has been communicated to its affiliated members by the National Chamber of Trade. To the latter bodies the resolution was accompanied by an explanatory note giving facts and figures about the two main points the Society wished to emphasize: the cost of smoke to business, and the waste of fuel involved.

One hundred and sixty-six local authorities supported the resolution and a number of these also drew the attention of their local Chamber to the subject, and mentioned how they were following up the matter in other ways.

Among the Chambers themselves
(*Concluded at foot of next page*)



From our Photo-Library—12

Wm. Jackson

Seascape

The Conference Resolutions—concluded

it is evident that much sympathetic interest was aroused, and for example one of the larger Chambers is printing the Society's notes on the matter in the form of an article in its monthly journal, which circulates among some 2,500 firms.

Some local press publicity has been given to the discussions at Council meetings, and another sequel that is warmly appreciated by the Society is that, in response to an invitation with which the resolutions letter

ended, nearly forty further authorities have become members of the Society. With this welcome strengthening of support the number of local authorities now affiliated to the Society rises to a total of 423.

Altogether, therefore, the Society can congratulate itself on a modest but successful activity. What practical results may follow the discussion and publicity it is so far hard to say, but the point is, as in so much propaganda work, it has been made easier for the desired results to be attained.

The Vomitories of London

Two Old Pamphlets Come to Light

Is it Impossible to Free the Atmosphere of London in a very Considerable Degree from the Smoke and Deleterious Vapours with which 'it is Hourly Impregnated'?

THIS ponderous question, the reader may be surprised to learn, is simply the title of one of two nineteenth century pamphlets that have come into the Society's possession. It is a brief, six-page essay by one W. Frend, described as an actuary of the Rock Insurance, and was published in 1819.

Frend was no engineer or inventor, but seems simply to have been one of London's more perceptive and enlightened citizens. This is how he begins his little tract :

"The Smoke of London, first viewed from a distance, affords a sight which strikes a foreigner with astonishment. The inhabitants are so accustomed to it, that they cease to regard it as a matter of much inconvenience, though a box of clothes sent from the metropolis sensibly affects their country friends. In fact, the Londoner is in the situation of a man who lives in a smoky house : he is used to it : but everyone who comes to visit him, perceives the difference between his sooty chambers and a well ventilated mansion.

"There are people, who, from long habit, are not disgusted with dirt and nastiness. The Hottentot returns to his grease : but, I believe, that, if the smoky atmosphere of this great city was exchanged for a purer air, none of the inhabitants, or the occasional visitors to the metropolis, would lament the loss of their black fog. All talk of the smoky town ; but they sit contented under their dense vapours from an opinion, that the evil is incurable."

He draws an odd, but interesting, parallel :

"This is the case with every im-

provement that is suggested. A few years back, the visitors to Bedlam were assured, that it was impossible to keep the unhappy patients but by such immense locks, bolts, and chains, as shocked humanity. The very people, who were thus manacled and fettered, are now walking about at their ease in the new Bedlam, and are more tractable in consequence of the removal of these restraints. I went over this excellent institution the other day, and on contrasting it with what I had seen in the case of the great works in and about London, this principle is almost entirely neglected. A man, for example, erects a brewhouse upon a small scale : his business extends, and with it his works gradually increase, so that what was at first scarcely felt now becomes a nuisance to a very great extent, and a volume of smoke is emitted, which is felt in magnificent houses at a very considerable distance from his brewery."

He continues by suggesting that higher chimneys would help, and goes on to ask "Is it possible to contrive it so, that the column of smoke proceeding from the greatest vomitory in the metropolis, shall not exceed that from a common kitchen chimney ?"

The Encircling Flue

He imagines a brewery in which the flue runs round all four sides of the building, with a small vent at each corner, so that most of the smoke is lost during the course of its journey and the remainder emerges through several apertures, where it "at least will be speedily diluted with the common air." This may sound absurd, but Mr. Frend modestly says he is only giving hints, and he mentions a lead works he had seen in the north, where a serious nuisance had been cured by connecting all the furnaces with a common chimney a considerable distance from the works. "The

consequence was that a vast quantity of deleterious matter was retained in the chimney and afforded an annual rent to the proprietors: and what came out at last was at such a distance from the workmen, that it could not produce any injurious effects on their health."

"I lay it down, then, as a position," he says, "that the smoke emitted by the vomitories, may be greatly reduced in quantity; that the expense of doing it is trifling in comparison of the profits of the works; and that the Legislature will not be ill employed in taking such measures as shall secure the public from its present nuisance."

Prior Approval Urged

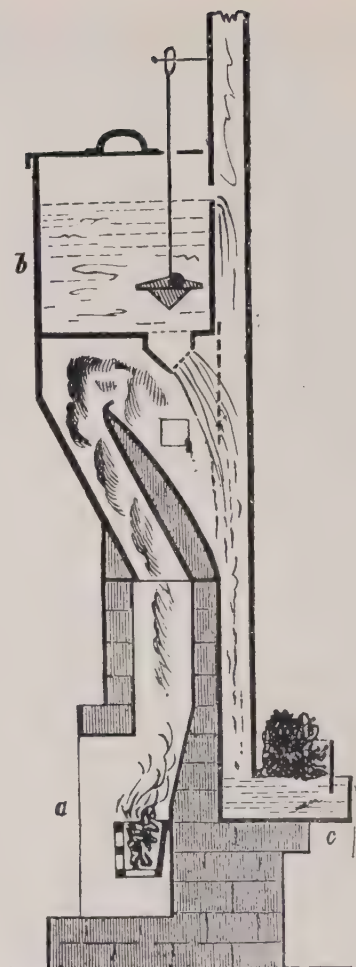
Finally, he has a sensible four-point programme for an inquiry, including what is possibly the first suggestion ever made for prior approval. First, there should be an investigation of different installations and comparisons made of the quantities of coal they consume; secondly, the expense of abolishing the smoke must be considered; thirdly it would have to be decided whether the proprietors of old works could pay for the alterations or might be indemnified in part by the public; and lastly: "to prevent any new works, unless on regulations adopted on the principle that a furnace should not be permitted to emit more smoke than a common (domestic) chimney."

The Legislature, 133 years later, would still not be ill employed to consider these proposals.

The Water Cure

Next we come to a 48-page booklet written in 1869, half a century later, by C. J. Richardson. He was an architect, a consulting engineer for the heating of buildings, and a pioneer in the use of oil for steam-raising. He was also the author of *Picturesque Architecture for Mansions, Villas, Lodges, Cottages, and Garden Seats*, and other books.

His pamphlet is on *The Smoke Nuisance and its Remedy by Means of*



Washing Domestic Smoke

Water. The idea is simple, and in a way anticipates the far more efficient wet-washing processes for flue dust removal that are in use today. Its effectiveness with domestic smoke, which is all he is concerned about, must, however, have been very small, and from an operational point of view was hardly likely to have succeeded even on a limited scale.

The accompanying diagram from the booklet, illustrates the principle. A cistern of water above the fire sends a continuous spray of water across the flue. It carries down the soot and smoky particles which are shown accumulating in a collecting tank. This was the arrangement actually used experimentally by the author "from time to time for a few months," but a much more elaborate system, complete with a heavily ornamented cistern, in the best Victorian tradition, is also described.

Mr. Richardson was trying to kill two birds with one stone, for the intention was that the water should pass down into the drains and sewers, thereby overcoming London's other great nuisance, the sewage. This would be deodorized by the smoke deposits, and being neutralized would yield a manure of double the ordinary value.

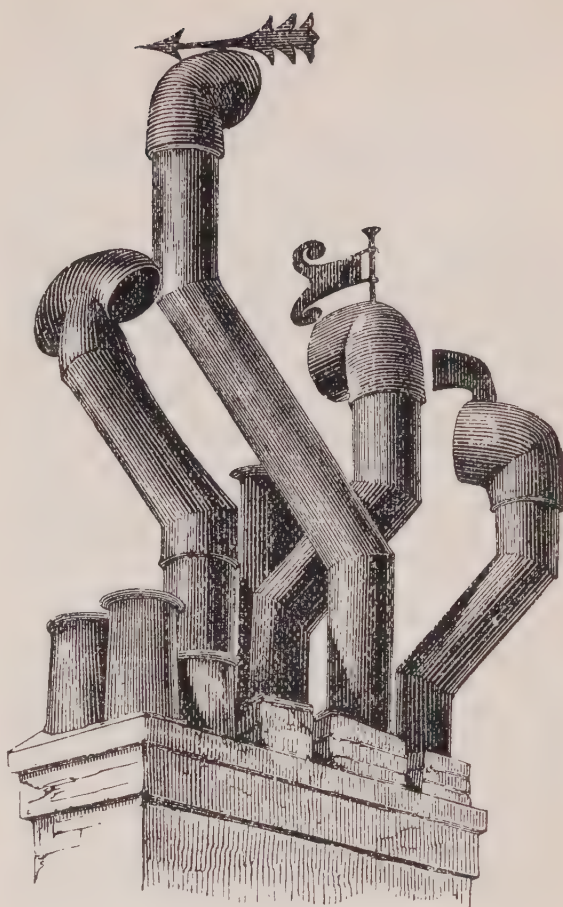
The idea, the author admits, was not original, for a Mr. Chaplin had taken out a patent in 1852, and this was a repetition of one granted in 1814 to "the well-known Frederick Muntz of Birmingham."

The Abominable Skyline

From this the author passes on to castigate, as an architect, the ugliness of the chimney stacks of London, with their grotesque attempts to overcome down-draught with "rows of iron pipes called tall-boys, Hymalia funnels, Archimedian screws, lobster-and-crab cowls, triple-crowned caps, organ pipes"—and so on. Some examples are illustrated, and we reproduce what he calls a fair example of a common London stack, from Drummond's Bank at Charing Cross. He gives designs for improving the general arrangement and structure of flues and stacks, and for topping them with elaborately ornamented caps.

We are apt to smile condescendingly at such long-forgotten efforts, as no doubt a hundred years hence there will be smiles at some of our own quaint ideas. But if we think more seriously about them we begin to understand the conditions of the time, the technical limitations, and the way in which—as today—the more alert minority were pushing against the inertia of the mass. It was the Frennds and the Richardsons who in the long run made possible the progress that has come since their time.

Richardson's pamphlet is also of interest by reason of its final chapter on liquid fuel, and his description of the trials he conducted for the Navy at Woolwich, under Government control but at his own expense. And



London Chimney Stacks, 1869

we are also grateful to him for quotations from a *Times* leading article on the smoke problem (January, 1855). Some of what he calls this "powerful" article is well worth re-quoting :

"Smoke we have always with us. If we look out on a fine summer's day through the louvre boards at the top of the Crystal Palace for a view of the great Metropolis, we naturally exclaim, 'I see it—there is the smoke !' Indeed, any picture of London without its dark canopy of soot would be unrecognisable ; it is the black and heavy cloud arising from the 400,000 houses of London. In it we behold the great aerial coal-field, which contains annually no less than 200,000 tons of fuel which escape from us up our chimneys. Escape, did we say ? Oh that it did, and that we never heard or saw more of it ; but smoke, like a chicken, still returns to roost. . . ."

Reviews

Attack on Fuel Waste Continues

Several new publications on the fuel situation and fuel economy have been published recently. On national fuel policy is **Fuel Prospects**, a P.E.P. Planning broadsheet (P.E.P., 16 Queen Anne's Gate, London, S.W.1). The pamphlet begins by referring to the remarkable disparity between the N.C.B.'s plan to increase coal output by 20 million tons in fourteen years' time, while, quite apart from other increasing demands, the B.E.A plans in the same time, to double its present annual coal consumption of 33 million tons. It shows how fuel consumption increases with increase of national income. During the past four years national income has increased by nearly 5 per cent per annum and fuel consumption by about 3 per cent per annum. "The longer run problem then is to ensure that enough primary fuel is produced to sustain continued growth in the national income."

In considering the increasing production of coal stress is laid on the need for more research into reasons and remedies for the shortage of miners. "It is up to the N.C.B.," says the statement, "to promote intensive studies into all the factors affecting the attitude of the miner and the potential recruit to work in the pits—and apply the information obtained."

Then, it is pointed out that even if there is a long-run prospect of increasing supplies of fuel, little can be expected during the next few years. Except through improved utilization the immediate prospect is bleak. The conclusions reached are for co-ordination of production policies through the Ministry of Fuel and Power—which should take a much broader view of the responsibilities it has power to assume—and the creation of conditions which will allow consumers, too, to act in the national interest.

There is need for special tax relief for capital expenditure on industrial fuel-saving equipment and a system of coal allocation which penalizes the inefficient fuel user in industry, together with incentives for domestic consumers. More Ministry support for fuel efficiency research is also required.



Covering in part the same ground, but with a political party flavour, is a pamphlet **Make Coal Work Harder**, by Gerald Nabarro, M.P., and C. J. M. Alport, M.P. (Conservative Political Centre, 6 Victoria St., London, S.W.1, 6d.). It very briefly outlines the problem, and then considers fuel efficiency in industry and in the home. One or two of the conclusions reached appear to be based on too slight an examination of the many factors involved, as for instance "Every new power-house must use its latent heat capacity for district, industrial or domestic heating schemes." Other recommendations are however right on the nail, and we hope the authors are pressing in Government circles for action to be taken, for example on the following :

"The fiscal weapon must be used by the Government to the utmost. All fuel-economising plant installed in industry, including plant for electricity generation, should be certified on installation by an appropriate representative of the Ministry of Fuel and Power, and if eligible admitted as a charge by the Inland Revenue when calculating the liability of the Company concerned for taxation."

The section on fuel efficiency in the home has a paragraph on smoke abatement that says "any fuel efficiency policy must include measures to achieve smoke abatement in the case of domestic fires." Other con-

clusions are in line with the policy of the N.S.A.S., the Simon Committee, and others. As a voluntary organization straining on the leash to do more, we warmly endorse the following :

“A major publicity campaign in which the Government, local authorities and voluntary organizations co-operate, should be undertaken to bring home to the domestic user the importance of fuel efficiency.”



From the F.B.I. comes a pamphlet for industrialists called **Fuel Economy Pays** (Federation of British Industries, 21 Tothill St., London, S.W.1, 2s.). It is an outline of practical economy essentials that should be carefully studied by all managerial directors and staff. Fuel economy should begin in the board room, where a sound, short primer, such as this, is often badly needed.

The first section of the pamphlet deals with faults in boiler operation and their remedies. Then follows a section on the use of instruments for measurement and control, and finally the question of the efficient use of heat

is dealt with, including examination of the questions of thermal insulation and the recovery of waste heat.



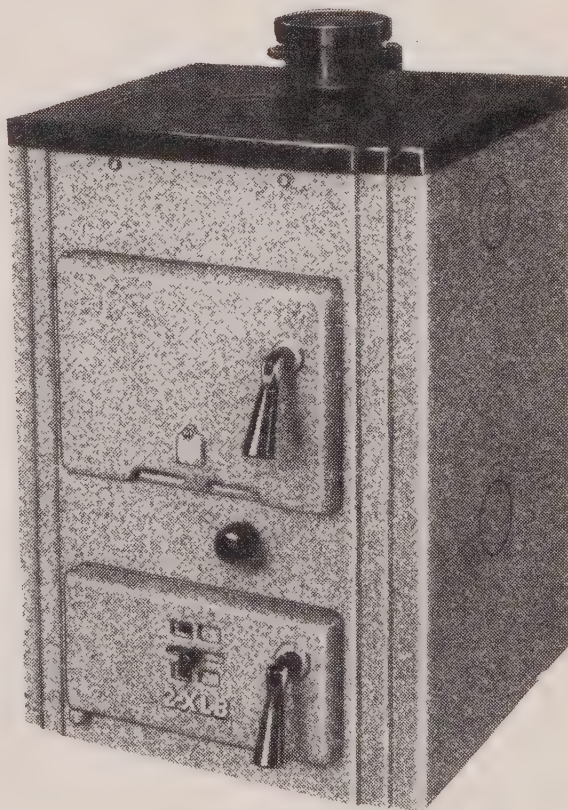
Also from the Federation is the annual **Fuel Economy Review** (1951, 2s. 6d.), which maintains its high and interesting standards. It reprints the pamphlet mentioned above and includes articles on fuel economy with particular reference to back-pressure and pass-out generation ; on the wind as a source of electrical energy ; and—what will be of particular interest to some of our own readers—on fuel economy in the steel industry.



In our last issue we published a report of the important conference organized by the Combustion Engineering Association in London last December. Readers may like to know that a complete record of the papers has now been published in book form under the title of **Proceedings of the Conference on “Meeting the Fuel and Power Shortage.”** (C.E.A., 6 Duke St., St. James’s, London, S.W.1, 10s. 6d.)

A New Ideal Boiler

The Ideal domestic boiler needs no introduction, and we illustrate an interesting new model—the No.2-XLB. The height is raised to allow for a deeper ashpan, and ash guides from the firebed assure all ashes being collected in the receptacle. The doors have all concealed hinges and positive locking catches which draw them up tight to the front frame, which allows for proper combustion and draught control. The fire also includes an automatic secondary air inlet, which besides keeping the door cool enables oxygen to pass over the fire and the gases to burn. A new rocking grate with simple but effective operation has been incorporated. The door handles are hinged but come to rest at an angle which is “off” the doors and prevent the danger of burnt hands.



Smokeless Zones and Prior Approval

From Papers by the Coventry Smoke and Factory Inspectors, read at a meeting of the Sanitary Inspectors' Association in Coventry on November 15th, 1951

(1) Smokeless Zones

By T. E. Willmott

PRESENT day smoke abatement legislation shows very little advance on that of 75 years ago though considerable improvements have been made in respect of solid fuel burning appliances, both industrial and domestic ; these improvements have not however, cured the smoke problem and millions of tons of coal are still wasted annually and the harmful effects upon the nation's health still exist.

It was, no doubt, because of this that the few enlightened looked around for new ways and methods to bring about improvements and to focus the eye of the public upon this evil. Here I think we should pay tribute to the National Smoke Abatement Society which by its past and present members has done, perhaps more than all other bodies or individuals collectively, to try and bring about a substantial reduction in the amount of impurities passed into the air we breathe.

Today we are speaking on two of the ideas aimed at reducing atmospheric pollution, these are what have become known as the "smokeless zone" and "prior approval."

Let us in the first instance deal with the "smokeless zone."

What is a "smokeless zone?" Well, as the name implies it is an area or zone in which the emission of all smoke is prohibited.

The idea originated from the late Charles Gandy at the time when he was chairman of the Council of the National Smoke Abatement Society in the middle thirties so it will be noticed that the idea, in this country at any rate, is fairly new.

The progress made in the past few years in the field of fuel combustion and the manufacture of smokeless solid fuels has enabled the formation of smokeless zones to be a practical achievement, and although this abolition of smoke from

our towns and cities will necessarily be slow there is no doubt that the ultimate goal can be reached, and when prejudices are worn down and the man in the street becomes more enlightened and smoke conscious this abolition of smoke will gain momentum.

The formation of smokeless zones at the present time, must, we think be regarded in the nature of an experiment, an experiment upon which, no doubt, the eyes of officials of progressive towns are focussed.

Although at present Coventry possesses the only smokeless zone in the country several other authorities have secured, through local Acts, powers to establish such zones.

Manchester, I think, can claim the honour of being the first authority to introduce into this country the idea of the smokeless zone, for in 1938 a survey was carried out in the centre prior to obtaining the necessary powers to put into operation. Unfortunately the war intervened and the operation of the scheme had to be deferred and the provisions of the Act relating to smokeless zones does not come into operation until next year.

The Coventry Act

On the other hand the war simplified matters for Coventry, for as you know, the devastating raids made upon the city reduced much of the central area to rubble. This, no doubt, went far in enabling the establishment of the zone to be comparatively easy. When the Coventry Corporation were promoting a Bill, which has now become the Coventry Corporation Act, 1948, for presentation to Parliament it was decided to include a clause for the establishment of a smokeless zone, so in 1947, the matter was considered and the proposed area marked upon a map. The area chosen was the

badly damaged central area of the city where it could be seen that it would be a workable proposition and its application would cause little interference with existing heating arrangements and the everyday life of the businesses, etc., also it was known that new buildings would arise and that these would be smokeless.

This area, though small—it is some 30 acres in extent—was chosen as the nucleus around which when the opportunity arose further zones could be established or the existing zone enlarged.

A survey of this area was accordingly carried out with the following results :

Total number of premises within the area 179, of these 97 were shops, 31 offices, 8 banks and 7 licensed premises, the remainder included a church, warehouse, factories, clubs, etc. ; there were nine caretakers flats and two private dwelling houses.

Of this number of premises it was found that 118 did not use solid fuel for any purpose. There were 144 open grates in use and 151 open grates not used, 25 central heating plants with 31 boilers and 11 domestic hot water boilers. It was estimated that 121 tons of coal were used on the open grates and this was burned between the months of October and April. All the central heating plants with the exception of two used coke or oil as fuel, the two exceptions had automatic under-feed stokers.

From what has just been said it will be seen that the number of premises within the area was not large and that most of these were shops and offices. Only one factory was affected which had a boiler plant. This was a small vertical boiler used for raising steam for a bottle washing plant, operated on an average three days a week and was started up each time with coal and then kept going with coke as the fuel.

By far the larger proportion of fuel used was coke and the only bituminous fuel used was that consumed on the open grates mentioned above and on two central heating plants.

The trend nowadays is towards electricity and gas insofar as shops and offices are concerned, and only if the building is large enough to be heated by a central heating plant is it usual to find solid fuel used, even then in nearly every instance smokeless fuel namely coke is used.

Between the time that the survey was made and the date of the operation of the relevant section of the Act, one of the two

central heating plants reverted back to the fuel for which it was designed, namely anthracite, so that the only central heating plant within the area which is using bituminous coal is one installed in a church.

This boiler is automatically stoked by an underfeed stoker and so far, from observations made, is working satisfactorily. Also practically every office has discontinued the use of solid fuel for heating and installed gas fires or electric heaters, whilst open coal fires in caretakers' flats and public houses have been replaced mainly by gas fires.

The appropriate section (Section 51 of the Coventry Corporation Act, 1948) came into force on March 1st last, so on that date the first smokeless zone in this country came into being.

Up to the present time some eight authorities have secured through private Acts the necessary powers to establish smokeless zones within their areas and probably in the near future some of these powers will be put into effect.

The problems of each authority are bound to vary but to establish a smokeless zone within the central area of most towns should not be a very difficult matter even in these days of shortages of the kinds already mentioned.

The First Zone

Obviously, the first area chosen would be the central area of any town, where principally the buildings would consist of offices, shops, places of entertainment, etc., the majority of which would be found to be heated by gas and electricity or smokeless solid fuels ; to find such premises heated by bituminous coal burned on open grates is now the exception rather than the rule. It has been observed in Coventry that the change-over from solid fuels to gas and electricity in the kinds of premises just mentioned has, during the past five years, proceeded at a rapid pace ; this may be due in some degree to the difficulty in obtaining coal but in many instances the occupiers of these premises have realised that there are more efficient and cleaner methods of heating their premises and have only needed a little inducement to make the comparatively inexpensive change-over and what applies in this respect to Coventry no doubt applies to other towns.

This area would have to be carefully chosen and should, in order to make it effective, be as large as possible ; its boundaries however, would have to depend on local circumstances. Difficulties might arise if large industrial concerns

were included, so to make enforcement easy such places could be excluded from the operation of any Act in a similar way to which such premises can be excluded from any extension of our own zone. Of course, in such a case the zone would not in the true sense be smokeless, but we believe that it would not be difficult to persuade the management of any factory so excluded to bring their fuel burning installations up to date and eliminate practically all smoke.

The extension of any zone also depends upon several factors such as the type of premises in the proposed extension, the availability of the right type of fuel and fuel burning appliances and supplies of gas and electricity, but it should be borne in mind that to achieve its object the zone should be progressively extended, such extensions may take several years but should not be delayed too long.

(2) Prior Approval

By D. C. Norcliffe

Prior-approval of proposed fuel-burning installations can be described as the corollary of or the supplement to the smokeless zone. As a method of control of atmospheric pollution in an area it is less spectacular and of lesser news-value than the smokeless zone, but it has a more subtle effect in that control is applied to individual cases as they arise, and it consequently produces less opposition than the immediate prohibition of all smoke by one comprehensive enactment.

This country is not favourably disposed to radical change in any shape or form, even changes for the public good which are directed towards the establishment of a smoke-free atmosphere, and we in Coventry can testify as to the strength and bitterness of the opposition shown towards the proposals in the Parliamentary Bill. However, eventually Coventry's crusade and development of the new idea was successful, and in spite of a vociferous Town's meeting and a full-scale municipal ballot to decide the smoke prevention proposals and others contained in the bill, the solid common-sense of the citizens prevailed and the proposals became law in the form of the Coventry Corporation Act, 1948.

Not that Coventry can claim any credit for what is considered to be a new principle of legislation, in fact it is doubtful whether the principle can be called a

You will have noticed that the emission of any smoke in our own central area constitutes an offence, so that difficulties might arise even with the use of some of the smokeless fuels. At least one authority has foreseen this difficulty and has defined smoke so that it excludes any smoke which may be emitted when coke, anthracite or any other fuel of a type specified by the Corporation is used in a furnace, stove or other appliance which is suitable for burning such fuel and is properly maintained and used. This limited exemption will obviously make the work of those who have to enforce the Act much easier and we would have liked to have seen a similar exemption in our own Act, for after all if the use of bituminous coal could be prevented then the main cause of pollution of the atmosphere by smoke would be removed and we should be very near our goal.

new one. To my knowledge the principle "prior approval" has been operating with varying degrees of success in numerous local authorities throughout the country, and particularly in the Midlands, for a number of years, even though such schemes are without the backing of municipally sponsored Acts of Parliament. I consider that a tribute should be paid to those local authorities, advised and guided by their sanitary inspectors in most cases, that these forms of smoke control are carried on informally as part of the routine duties of sanitary inspectors without the glare of publicity, both local and national, which heralded the Governmental approval of Coventry's smoke prevention schemes.

It would be misplaced in this company of sanitarians to reiterate the indictment against the polluted atmosphere which hangs over our industrial areas and to repeat the tirade of serious consequences and effects on health and amenity of the smoke nuisance. The National Smoke Abatement Society (I wish its title were the National Smoke "Prevention" Society), as most of us are aware, has over a number of years fought an unrelenting battle against public apathy concerning atmospheric pollution and has spared no efforts in educating and informing the public regarding the dangers of this "aerial sewage."

The present "stable-door" legislation of controlling smoke emission by inflicting a penalty *after* the nuisance or act of default is committed is entirely inadequate. Smoke prevention, as distinct from smoke abatement, should take the form of regulating the conditions which may give rise to smoke, and attention should primarily be given to the installation, the fuel used, and the manner in which it is burned. As Arnold Marsh so aptly phrased it—"It is a question of genesis rather than of exodus." The actual emission of smoke from a chimney can of course be used as a confirmatory factor that all is not well in the installation or that the necessary conditions are not being correctly observed.

Thus, it is apparent that a new principle of legislation is necessary, and as a result of the efforts of Society the principle of "prior approval" is rapidly gaining a strong foothold in this country, and whilst it has not as yet manifested itself in national legislation, it has in one form or another been incorporated in recent local Acts in London, Manchester, Preston, Rochdale, Salford and Coventry. The local Acts of Parliament vary one from the other in many respects, experience may show that they are inadequate and even inconsistent. However, their shortcomings and inconsistencies should not be criticized too strongly as they are, after all, mere sounding boards or acts of groping toward a new and very important principle in the field of smoke prevention and from them should emerge, by experience and comparison, a more workmanlike formula of national legislation.

It cannot be said that local Acts of Parliament incorporating smokeless zone and prior approval schemes are the universal panacea for all atmospheric pollution ills throughout the whole country. Obviously, smaller local authorities would not have the need for such powers, or if they had the need the specialist staff to operate such control could not be afforded by, nor would they be available to, many of the small and especially the rural authorities. If for no other reason therefore, prior approval control should be placed on a regional basis, similar to the regional joint action which already exists in some areas.

Broadly speaking, prior approval as advocated by the National Smoke Abatement Society and manifest with varying conditions, procedure and phraseology in the different local Acts of the cities and towns referred to, makes it an

offence and prescribes a penalty if a person installs a furnace for steam raising or for any trade or manufacturing purpose which is not smokeless. An arrangement is laid down whereby plans, proposals and particulars of the furnace are submitted to the local authority for perusal and a person may thereby learn whether or not his proposed furnace is likely to comply with the aforementioned requirement. Thus the procedure is analogous to that dealing with plans for new buildings by building byelaw control in which it is desirable, for public health, safety or amenity, to ensure conformity with certain standards.

It may be a surprise to some that a form of prior approval has been operated nationally in this country for a number of years with regard to a special type of installation. These installations are plants which require to be registered under the Alkali, etc., Works Act, 1906, and the Orders of 1928, 1935 and 1939, and are to be found in the chemical and other manufacturing industries in which chemical actions are involved. The Acts and Orders are the direct concern of the Ministry of Health and are administered by a Chief Inspector and Regional or District Inspectors. A chemical process which is registerable under the Act and Orders cannot be legally operated until the Chief Inspector is satisfied that the best practicable means are incorporated for reducing the emission of noxious vapours.

As mentioned previously, smoke prevention control should deal primarily with the fuel-burning installation, the fuel used and the manner in which it is burned. No doubt manufacturers of furnaces, boilers and allied equipment consider that they are the only people competent to decide the proper type of installation to be fitted. Considering the technical and functional aspects, to a certain extent they are right but to my mind only right by reason of the fact that fuel economy is now more than ever before an inducement to improved design and, fortunately, fuel economy and smokelessness go hand in hand. Thus, happily for we sanitarians, the by-product of smokelessness emerges from the researches of the combustion experts and furnace designers into the realms of improved fuel economy. In a similar manner, prior approval has the effect, by a process of natural selection of smokeless installations of promoting national fuel economy and also of the ultimate rejection of inefficient appliances thus rendering unnecessary the strict and



Rebuilding in the city centre, Coventry

(Courtesy Coventry Evening Telegraph)

perhaps unwieldy initial control over manufacture of plant which is the keynote of many American ordinances.

Coventry's Prior Approval Scheme

Coventry's scheme for the prior approval of fuel-burning installations is contained in Section 52 of the Coventry Corporation Act, 1948, wherein it is laid down that :

“No person shall instal in any building in the City whether erected before or after the passing of the Act any furnace for steam-raising or for any manufacturing or trade purpose unless such furnace is so far as practicable capable of being operated continuously without emitting smoke.”

There is a specified continuing penalty of not exceeding £2 for each day on which the offending furnace is used after conviction. In the case of a proposed new installation, in order that the person concerned may learn whether his plant is considered to be likely to comply with the aforementioned requirement, he *may* submit “plans, proposals and particulars” of his proposed furnace to the Corporation. The submission of plans, etc. is a

voluntary act, but when this is not done and the result is a smoke-producing furnace, the preceding clause may be invoked against the defaulter. Where, in accordance with the Act plans, etc., are deposited, the Corporation shall within six weeks serve a notice on the applicant stating whether or not they are satisfied that the furnace is so far as practicable capable of being operated continuously without emitting smoke, and if they are so satisfied or if they do not serve such notice within the six week period, no proceedings shall be taken against the applicant under the first part of the section in respect of the installation specified in the application.

The scheme commenced to operate in Coventry in October, 1948, which was over two years before the Minister gave consent for the smokeless zone to come into effect. As a means of publicising the provisions, and the conditional concession contained in the Act, all private and industrial architects in the city were informed by letter of the requirements and of the form of submission of the proposals. Where plans are submitted to the City Engineer for permission to erect boiler-

houses and factory extensions, etc., the managements are informed of the prior approval scheme and an application is usually forthcoming. If the proposed plant does not comply with the Corporation's code of requirements, discussions with the management are arranged and in every case so far the necessary adaptation has resulted. As one of the pioneers of this form of smoke prevention Coventry has had to formulate unaided its own code of requirements against which all applications are considered. The code is not wholly rigid except in a few basic necessities such as requiring mechanical methods of firing bituminous fuels, compliance with the Ministry of Fuel and Power Fuel Efficiency Bulletins for liquid fuel installations, the provision of suitable grit-arresters where necessary, draught gauges in appropriate cases, smoke indicators, etc. Some of the requirements are, of course, varied according to the size of the installation, and other requirements and recommendations contained in the code have reference in a general and flexible sense to the size of the boiler, area of firegrate, ratio of heating surface to grate area, draught production and secondary air supply, dimensions, construction, maintenance and type of flues and dampers, feed water arrangements, and auxiliary boiler house instruments.

It will be noted that our scheme for the submission of plans, etc., of proposed installations is a voluntary act. The same principle is applied in Manchester's Act and in several of the others except that of Preston Corporation which makes it obligatory for the plans, etc. of all new installations to be submitted for approval.

There are also other minor differences between the various local Acts of Parliament and the variations can only be accounted for as differences in the particular requirements of the individual local authorities' promoted bills, and the inconsistencies of the powers-that-be in allowing a more stricter form of control in one local Act than in another. The provision for discussions with the Ministry of Fuel and Power in the event of the disapproval of an application reflects, perhaps, some anxiety on the part of the Government about the way the new legislation is developing.

Difficulties met with in practice

Most legislation has its loopholes, its drawbacks and its deficiencies, and Coventry Corporation Act, 1948, cannot claim to be an exception. We who assist in its administration can point out several

of what sanitary inspectors are wont to refer to as "difficulties met with in practice." For instance, we bemoan the fact that the scheme is a voluntary one, we complain when the liaison with other Corporation Departments is not all it should be at all times, and we regret that the control is limited to steam-raising or in the case of any trade or manufacturing purpose. The application of the qualifying phrase—"any trade or manufacturing purpose" has in certain circumstances raised difficulties, and legal opinion has had to be sought regarding this and other matters. The questions of heat recovery plants, waste heat boilers, hybrid installations, incinerators, etc., have all been raised, and no doubt members present here today from Midland areas with specialised industries could think of, and would be faced with in like circumstances, intricacies far more terrifying than those which are likely in Coventry. However, it cannot be denied that these local Acts aimed at smoke prevention, whatever their shortcomings, have broken new ground and established precedents of major importance. Also they show that it is practicable to frame legislation embodying a new principle of control and to secure its approval by Parliament.

Another criticism levelled at Coventry's prior approval scheme is that no knowledge can be obtained of additions and alterations to plant in existing premises, although, where smoke emission results from such alteration or addition of a major kind, no doubt the punitive clause in the Act and certainly the Public Health Act, 1936, may be invoked against the offender. In any case, taking a long term view of the scheme, natural obsolescence and wear and tear should bring all existing plants into line eventually, although it is hoped that national legislation will be in operation in the near future which will by a similar formula, or a more efficient one, considerably accelerate the pace at which offending installations are scrapped. Extensions of the smokeless zone which are provided for in the Act, can also be used judiciously in order to increase the pace at which unsatisfactory appliances are eliminated. Here we reach the essential "tie-up" between the smokeless zone and the prior approval schemes which to the uninitiated appear to be poles apart whilst they are, in effect, convergent and of mutual aid in their common aim.

Conclusions

In conclusion, I should like to draw
(Concluded on page 128)

ELECTRIC TRACTION AND SMOKE ABATEMENT

THE steadily increasing number of public service vehicles appearing on the roads each year, added to the private cars, raises a number of problems, the least of which is congestion. The most serious problem is the effect on the health of people due to the fumes emitted in the exhausts of these vehicles.

A smoky, fume-laden atmosphere by its irritant action on the respiratory system is definitely harmful, and a well-known medical man has stated that lung cancer in humans, from being a rarity during his student days twenty-five years ago, has increased over twenty-fold today. This is not surprising when it is realized that it has been calculated that the central London buses add 31,000 tons of soot per annum to an atmosphere already polluted by the soot from domestic and industrial chimneys.

The solution to this really serious problem is the use of electric traction wherever possible, trams, trolleybuses, battery-electric vehicles for delivery work, and increased electrification of the railways to eliminate the smoke and soot emitted from locomotives.

The electric vehicle, whether it be tram, trolley-bus, battery-electric van, or a railway train, possesses the great advantages of rapid acceleration, rapid and safe braking and, almost silent operation. A complaint frequently levelled against trams is that they are noisy, and so they may be if they are not modernized or well maintained. Modern trams with resilient sections in the gearing and rubber inserts in the wheels are virtually silent. The present trams in Blackpool are of this type, and their silence has to be experienced to be believed.

Under the mistaken impression that they are being modern and enlightened, authorities in various parts of the country are pressing for the replacement of trams, and even trolleybuses, by motor buses. If they really were

enlightened, they would never agree to abandon electric road passenger transport in favour of a system which takes away from the health and cleanliness of a city or town. If health and cleanliness were valued at their true worth, the question of replacing electric traction by any other system which was deleterious in any degree to health and cleanliness, would never be considered.

Apart from the health factor, the more we adopt electric traction the less imported fuel we need. Actually the coal used to generate electricity is of a low grade quite unsuitable for most other purposes.

The Battery-Electric Vehicle

The ideal vehicle for light delivery work—milk, bread, etc.—is undoubtedly the battery-electric vehicle, which is becoming increasingly used in the form of mobile shops for reaching isolated communities. The absence of oil and fumes to pollute the interior atmosphere of these electric vehicles and contaminate the goods which they carry has been a not inconsiderable factor in influencing their adoption by a large number of progressive traders. Both the vehicle and the driver remain clean, and where food-stuffs are concerned the importance of this is obvious.

As the battery-electric vehicle makes such a great contribution to the maintenance of clean atmospheric conditions, it is proposed to deal in greater detail with its characteristics.

Available as 4- and 3-wheel driver-seated types, or as pedestrian-controlled vehicles, the heart of the vehicle is its battery—a simple piece of apparatus requiring little more to maintain in sound working condition than recharging after its day's work is done. The electricity required for this purpose is available from the mains of the Electricity Boards after genera-



Left—*Electric - driven
mobile self-service shop*

Below—*Trolley-bus*

tion in the power stations of the British Electricity Authority. All that is required is an automatic charger which is normally connected to the electricity supply in the owner's depot or garage. When the vehicle comes in after the day's run it is merely plugged in to the charger and switched on. An automatic device ensures that the current is switched off when the battery is fully charged. The batteries are recharged during the night when the vehicle is in its garage.

The night time, of course, coincides with the period of minimum load on the electricity supply system. On this account, therefore, especially favourable rates are available in many districts for the recharging of electric vehicle batteries during the night.

Power Consumption

The amount of electricity consumed on a day's round depends upon a number of factors, e.g., weight of load, length of round, type of country, number of stops, etc. The average figure for a 10-12 cwt. vehicle, is approximately $1\frac{3}{4}$ miles per unit of



electricity, and for a 20 cwt. vehicle, approximately $1\frac{1}{2}$ miles per unit of electricity. A pedestrian-controlled vehicle will travel approximately 3 miles on a unit of electricity.

Although the top speed of an electric vehicle is usually around 18-20 miles per hour, many tests have proved that it will cover a normal delivery round with possibly more than 200 stops and be back at the depot well before a so-called "faster" vehicle. The reason for the high

average speed of delivery and collection is simple: it accelerates much more rapidly from a standing start than any other vehicle. It pulls up quickly and smoothly. The average stream speed of traffic in most urban areas is under 10 miles per hour, so that high top speed is of no advantage.

The electric equipment needs scarcely any maintenance beyond occasional greasing and attention to motor brush gear and controller contacts. The chief things to be done are to keep the battery topped up with distilled water, check tyre pressures and grease main chassis points.

The battery-electric vehicle is inherently quiet in operation, and as noise is by no means the least disturbing influence in modern life, its general reduction, especially in busy streets, would be a real service to the community.

Progress in the development of reliable batteries has been substantial during the last few years and battery-makers now give a four-year guarantee with their products. It has, however, been found in practice that, provided they are given a reasonable degree of attention and are not abused, batteries can last for five years or so.

In arriving at the figures given, certain well-proven facts have been taken into consideration. Due to its more simple construction the electric vehicle has a much longer life than a vehicle with an internal combustion engine. The reason for this is that the far more complicated high-speed power unit is efficient only during a comparatively short life. Maintenance costs soon become excessive and its continued use is uneconomical.

An engine doing short-run delivery work is doing work thoroughly unsuited to it. It is constantly stopping and starting. Alternatively if it is left running whilst the delivery is being made, it is wearing itself out unnecessarily and wasting fuel. The electric motor is ideal for work involving constant stopping and starting. The loss of efficiency is negligible over many years.

The number of battery electric vehicles in use has grown steadily year by year. Whereas in the year 1938 there were only 4,156 registered, in 1950, the last year for which total figures are available, the number had increased to no fewer than 17,613 driver-seated vehicles plus 7,622 pedestrian-controlled vehicles, making a total of 25,235.

Prior Approval—concluded

attention to some other factors which emerge from this new conception of a sanitary inspector's work. It is true to say that "prior approval" when fully developed into a forceful method of smoke prevention control, will require a deep knowledge of combustion technicalities. A knowledge far more extensive than that required for an inspector to know merely whether or not a chimney is smoking, which was the usual total assessment of our duties in the eyes of some uninformed persons and which the specialist title of "Smoke Inspector" does nothing to dispel. Of all the branches of a sanitarian's work in an industrial area surely this is one in which a more intensive training and a high degree of specialization is essential, if only with regard to the necessary attainment of

uniformity in both standards and administration. Also, going further, whether there be similar national legislation in operation, regional joint action, or local legislation, or even the informal advisory procedure, co-ordination of practice and technical co-operation must be achieved, preferably in conjunction with an advisory service to give, where required, a high-level of constructive assistance in all fuel-burning problems.

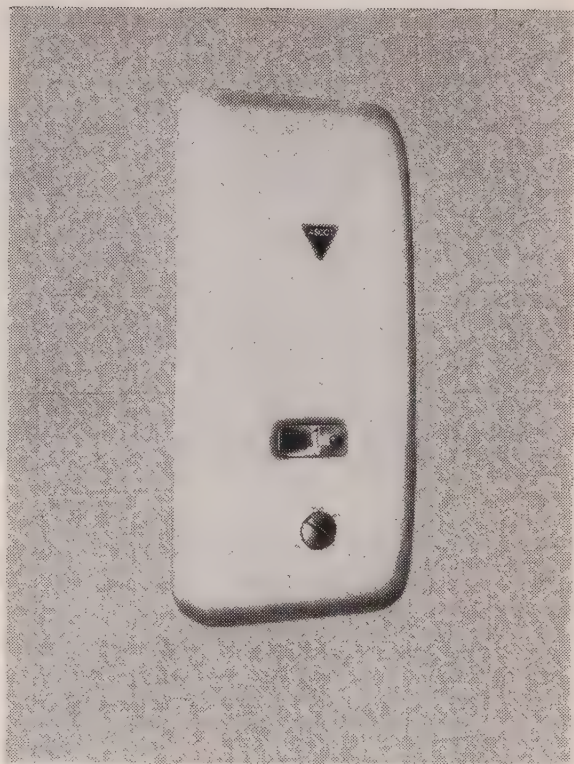
Finally, we as technical officers of local authorities' staffs could work wonders in this field if we adopted a concerted plan for progressive action based upon this new principle, and it is appropriate that we who have secured pure food and pure water should expend still further efforts on the one single action still open to us, which no other could do more for positive health, of the abolition of smoke.

The Balanced Flue Gas Water Heater

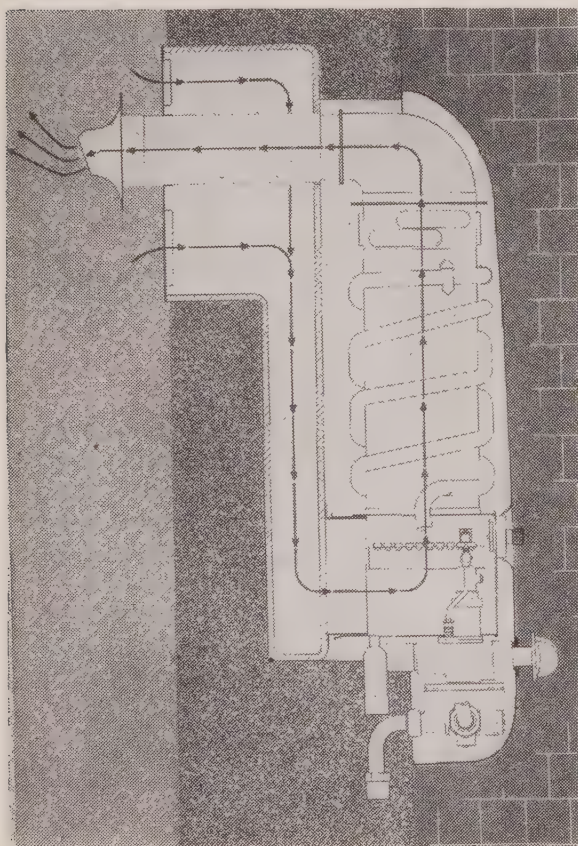
The Ascot Company, which has pioneered so much water heating progress, is now responsible, in the Balanced Flue Heater, for an outstanding development.

The adjoining diagram illustrates the principle. The heater is fixed on an external wall, from which it has a maximum projection of only five inches, and is totally enclosed. Air for combustion is drawn through a duct from the external atmosphere, and the products of combustion pass out into the open air through the inner duct, as shown. It can thus be installed and used as much as desired, in even the most confined space without any possibility of vitiation of the atmosphere of the room.

The photograph of the heater shows the neat, clean appearance that has been obtained, and the duct terminal ventile shows how equally unobtrusive are the external parts. The importance



The Heater



Showing the circulation of fresh air and products of combustion through the enclosed ducts and heating body

of this in multi-storey flats will be appreciated. The appliance has, of course, been developed mainly for new housing, but it can be fitted in any room or cupboard without regard to the ventilation present.

The principle itself is not new, and goes back to the last century, but the inherent problems were such that for years a balanced flue heater was regarded as little more than a theoretical dream. Only lengthy and expensive research has led to the present product. The Ascot people say that if it had not been for their extensive laboratory facilities and the experience they gained during the war in hydraulics, aero dynamics and pneumatics, they doubt whether they would yet have succeeded in marketing the heater. The two most serious problems, calling for very fine measurements, were the prevention of the re-circularization of the waste gases due to varying wind direction, and the effects of unstable pressures caused by eddies of constantly changing wind velocity and composition.



The duct terminal ventile of the balanced flue gas heater

Many housing authorities have already specified the Balanced Flue Heater for their projects, and heaters have been sent for testing purposes to

a number of overseas countries.

More information can be obtained from Ascot Gas Water Heaters Ltd., 43 Park Street, London, W.1.

Correspondence

Underfeed Stoking

*To the Editor,
Smokeless Air*

Sir,—In tackling smoke abatement and fuel efficiency, I reported to my Council that the Public Baths Chimney was one of the worst offenders in producing smoke. On my advice the Council agreed to install underfeed stoking to the Lancashire boilers. After installation, using washed pea coal, it was found that a saving of 38 per cent. of fuel (equal to 3 tons weekly) had been effected. Further smoke emission was non-existent, there was a better head of steam and less clinker removing.

After this I was able to approach a laundry which was to install new boilers, with the request that underfeed stoking be provided. I then gave the firm a guarantee that there would be at least 25 per cent. saving in fuel. Obviously, as a local authority representative, I could not request a private firm to carry out smoke abatement measures when my Council were one of the offenders.

The laundry firm have had underfeed stoking in operation for over twelve months. It is interesting to report that the resultant saving after one year's working is 47.5 per cent. of fuel, with a financial saving of £975. The firm concerned have written to the Council, pointing out the effectiveness of underfeed stoking and thanking me for the advice I gave. In these circumstances I cannot speak too highly of the effectiveness of this means of saving fuel and combating smoke nuisance.

Yours, etc.,

HENRY WHITFIELD,
Chief Sanitary Inspector.

*Health Department,
Middlesbrough.*

Courtauld's Ltd. have approved plans for the construction of a scrubber plant—a giant concrete tower—at their Greenfield, Flintshire, works. It incorporates an intricate chemical purification process designed to wash clean all smoke and fumes emitted from the manufacture of rayon. Estimated cost, £250,000.

Review of the Gas Industry

Second Report of the Gas Council

IN the winter issue of *SMOKELESS AIR*, 1951, we reviewed the year's work of the British Electricity Authority as recorded in their third annual report. The activities of another great public service that has contributed in the past and is likely to contribute even more in the future to the avoidance of atmospheric pollution are now recorded in the second annual report of the Gas Council for the year ending March 31st, 1951.

It is necessary to bear in mind that whereas the British Electricity Authority is an organization responsible for the generation and distribution of electricity to the Area Boards, the Gas Council is not itself a trading body although power is reserved to it to manufacture gas appliances and plant for sale to Area Boards. It has no direct responsibility for the reports and accounts of the twelve Area Boards, but it is responsible for labour relations and research and the provision of capital.

The Gas Council consists of a Chairman and deputy Chairman and the chairmen of the twelve Area Boards, and except for the three issues mentioned above reserved to it, the Council can only recommend. It is interesting to note that recommendations made after free and frank discussion have been loyally accepted by the Area Boards, and to this extent the experimental decentralized organization is working effectively.

In respect of the operations for the year 1950-51 nine of the Area Boards made a profit of some £2,000,000 while three of the Boards made a loss of some half million pounds. The Gas Stock issued in compensation amounts to some £230,000,000. The temporary borrowing powers of the Council have been increased by the Minister of Fuel and Power from £15,000,000 to £50,000,000.

The gas supplied by the Area

Boards amounted to 2,666,000,000 therms of which 88 per cent. was coal, water or other gas made in the Boards' own works, 12 per cent. was bought from coke ovens and a small amount, .25 per cent., was bought from oil refineries by the North Western Area Board.

The industry carbonized 26,368,700 tons of coal, an increase of 4.4 per cent. on the previous year, of which 65 per cent. was carried by rail, 30 per cent. by coastal collier and 5 per cent. by canal or road.

Coke

The coke produced by the Area Boards excluding that used for heating retorts was 11,847,000 tons and of this 2,047,300 was used in the manufacture of water gas and for other purposes. About 2,000,000 tons only went for use in domestic appliances. We should like to see a larger quota going for domestic use, leaving much of the raw coal at present burnt in domestic grates with production of smoke, for industrial use where, with proper appliances, it can be burnt efficiently without smoke. 630,500 tons of coke and 255,800 tons of breeze only, went for export.

It is interesting to note that it is realized that the efficiency of both industrial and domestic coke-burning appliances depends on the use of the right type of coke and that the necessary advisory service should include advice on the selection and supply of cokes and appliances, guidance on installation and operation of appliances and immediate investigation of difficulties. We have seen some appliances of unsuitable type, and others improperly installed, and although the difficulties of setting up such a service are realized, we consider it to be essential if our fuel is to be economically and efficiently used.

The industry recovered 25,632,000

gallons of benzole most of which was marketed as motor spirit by the National Benzole Company. It enjoys a preference on imported spirit of ninepence a gallon.

Commercial Managers' Committee

The Council has appointed a Commercial Managers' Committee on which all areas are represented. On the advice of the Committee a universal hire purchase agreement has been introduced. The Committee has also advised on the marketing of domestic coke appliances, the preparation for local authorities of lists of approved appliances, and the supply of gas to new towns and housing estates.

The West Midlands Gas Board appeared before the Committee on the Wolverhampton Corporation Bill which gave the local authority power to establish smokeless zones. The Committee recommended the retention of the absolute exemption of gas and electricity works, but the House of Commons decided on a compromise whereby a Gas or Electricity Board may, if it appears to be affected detrimentally by a Smokeless Zone Order, apply to the Ministry of Housing and Local Government for its variation.

The spent oxide from purifiers has been in increasing demand for its sulphur content since the reduction in imports of pure sulphur.

The Council has had under review problems of research in the industry and has appointed a permanent Research Committee. On the advice of the Committee the Council decided as a first step to establish two Research Stations, one in London, the Fulham Laboratories of the North Thames Gas Board, and one in Birmingham at the Nechells Works of the West Midlands Gas Board. The problems under review include complete gasification, gasification of fuel oil, recovery of sulphur, disposal of liquor effluents, manufacture of plant and appliances. The Council and Area Boards have also supported research carried out by organizations not exclusively concerned with the gas industry.

Surveys have been carried out on the need for new appliances, such as new types of efficient cookers to replace obsolete types, water heaters, etc.

The report deals with other problems which the Council and the Area Boards have to face, finance, involved problems of rating, rising capital costs of replacement plant, tariffs and prices, education and training of personnel, supplies of gas to new towns, etc., and indicates the progress that has been made towards developing an efficient co-ordinated and economical system of gas supply and to meet all reasonable demands for gas.—A.J.C.

SMOKE PREVENTION ABSTRACTS

178. Flue Dust : An Urgent National Problem. (Scope, January, 1952) Discusses the problems caused by the dumping of dust from pulverized coal burning, the costs of disposal, and possible means of utilizing the material for the extraction of rare metals such as vanadium, gallium and germanium. Reference is made to the considerable progress being made in some places in the U.S.A. in the utilization of the material.

179. Influence of Carbon Smoke on Corrosion of Metal Surfaces Exposed to Flue Gases Containing Sulphur

Trioxide. Kear, R. W. (J. Appl. Chem., September, 1951, vol. 1, 393-399). Further work has been carried out to assess the effect of the presence of carbon smokes on the corrosion of a mild steel surface by flue gases containing SO_3 . The results obtained have confirmed the view that a peak rate of corrosion obtains at temperatures of $20^\circ\text{--}40^\circ\text{C}$. below the dewpoint of the gas and that the presence of carbon smokes can profoundly affect the extent of corrosion. As the smoke concentration is increased from zero there is an initial

increase in corrosion but eventually the dewpoint of the gases and their corrosive properties are substantially reduced. Comparison of the behaviour of filtered and unfiltered smoke-laden gases would indicate that carbon reduces the SO_3 content of flue gases by a process of physical adsorption.

180. Sonic Agglomeration : A New Solution. Kiddoo, G. (Chem. Engng, May, 1951, **58**, 154-156). The primary function of a sonic agglomeration is to coalesce aerosol particles into large particles which can be removed in secondary collectors such as cyclones, impingement separators, or wet scrubbers. Particle vibration more closely approaches that of the gas, (1) the lower the frequency, (2) the smaller the particle, (3) the lower its density, and (4) the higher the gas viscosity. At any sound given intensity there is an optimum frequency for each particle size which gives the greatest relative motion for an aerosol containing a range of particle sizes. Lower frequencies, 1,000 to 4,000 c/s are more effective in agglomeration than ultrasonic frequencies. A minimum particles concentration is required to achieve a satisfactory number of particle collisions and subsequent agglomeration. Types of sound generators are described.

181. Reduction of Dust in Steel Foundry Operations. Bloor, W. A. (Foundry Tr. J., 12 July, 1951, **91**, 31-40). Methods were developed for measuring and continuously recording dust concentrations. These methods were used in foundries to explore the source, composition, and concentration of dust. The dust concentrations were shown to vary from foundry to foundry, and from operation to operation, and the importance of isolating dusty operations and removing the dust at its source were demonstrated. Some effects of foundry dust upon animal systems are discussed.

182. Reduction of Atmospheric Pollution by Sulphur Compounds. Craxford, S. R. (J.R. San.I., May, 1951, **71**, 209-212). Reviews tried

methods for the removal of sulphur compounds from flue gas, *i.e.* the B.E.A.-Battersea process and the Howden-I.C.I. (non-effluent) process, and discusses the Fulham-Simon-Carves ammonia process, and trials being carried out at the Fuel Research Station.

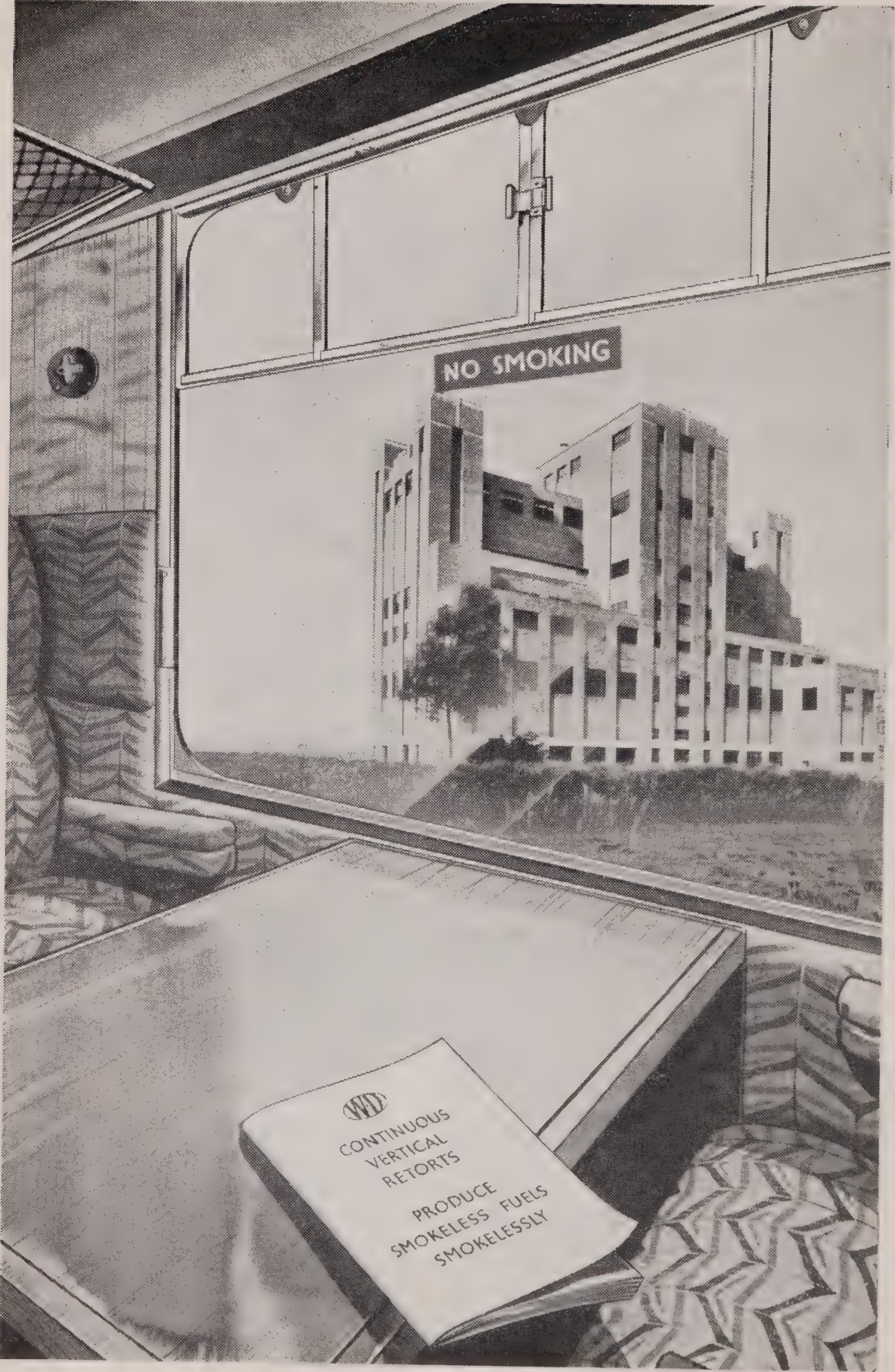
183. Reduction of Atmospheric Pollution: Elimination of Smoke. Sparkes, W. J. (J.R. San.I., May, 1951, **71**, 212-216). Briefly discusses the cause of smoke in boiler furnaces, and methods of smoke elimination, particularly the F.R.S. smoke eliminator door.

184. Measurement and Survey of Atmospheric Pollution. Richards, S. H. (J.R. San.I., May, 1951, **71**, 216-222). Reviews methods and technique for the measurement of deposited matter, suspended matter, and sulphur dioxide.

185. Smoke Abatement Advisory Committee. Pester, J. (Sanitarian, February, 1952, **60**, 204-207). A paper reviewing the formation, membership, and functions of the joint advisory smoke abatement committee set up in Burnley, Lancs., in 1949. It is found that the Committee has a good standing and is recognized as fulfilling a most useful purpose.

British Railways are to change over from steam to Diesel traction locomotives for yard marshalling and shunting, and plan to build 573 Diesel engines in a five-year programme starting in 1953. The scheme provides for 432 Diesel-electric engines of 350 h.p., and 141 Diesel-mechanical engines of 150-200 h.p.

Speaking to Oldham Health Committee recently about a proposed new smoke abatement byelaw, Dr. D. Hilson, a child specialist, said : " The reason I am anxious to see this byelaw in force is that out of every ten children I examine in this area, six suffer from asthma or sinusitis. Anything we can do to encourage reducing smoke we should do."





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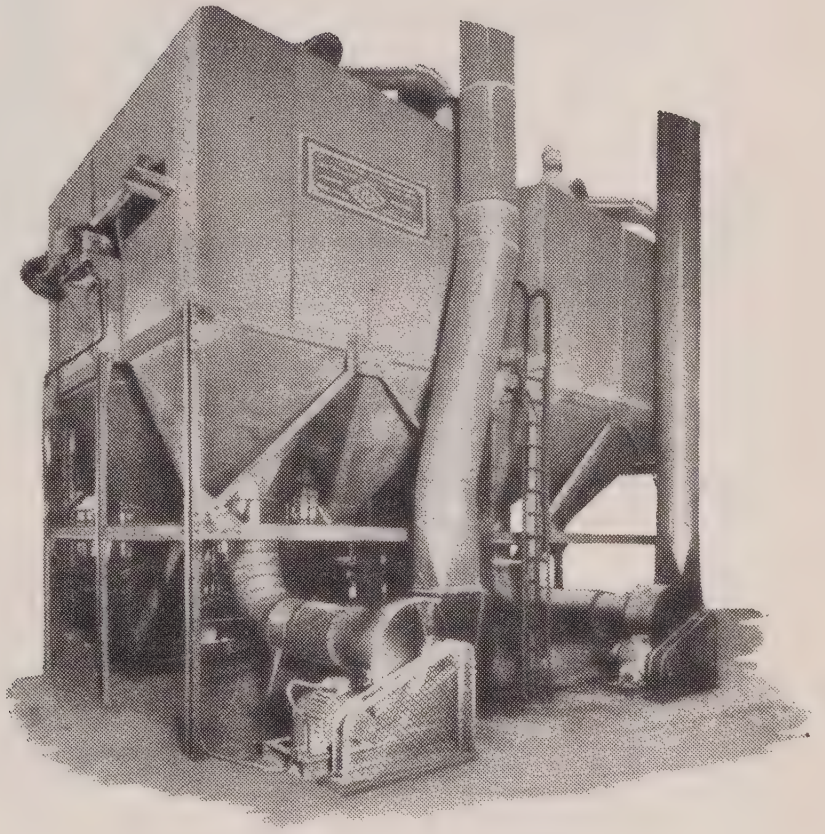
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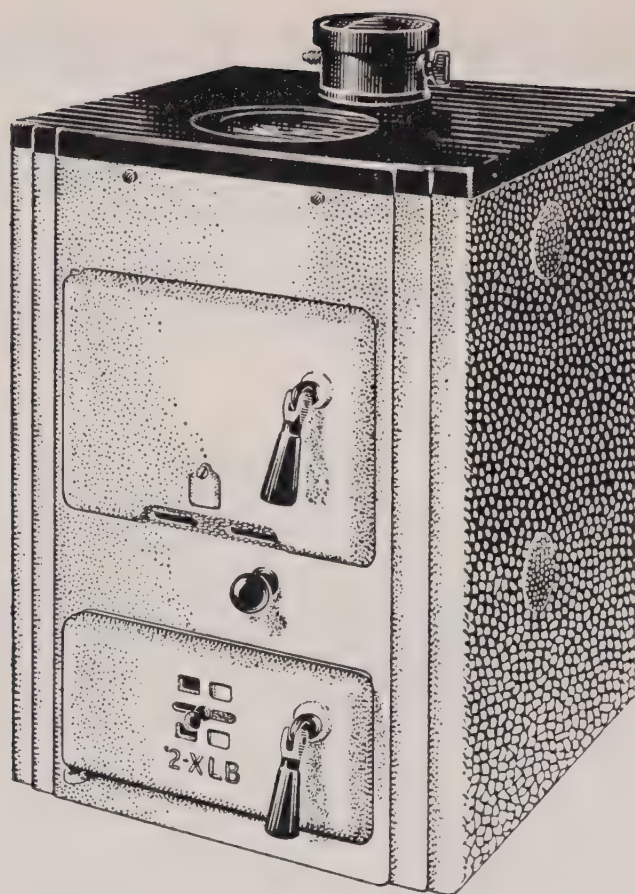
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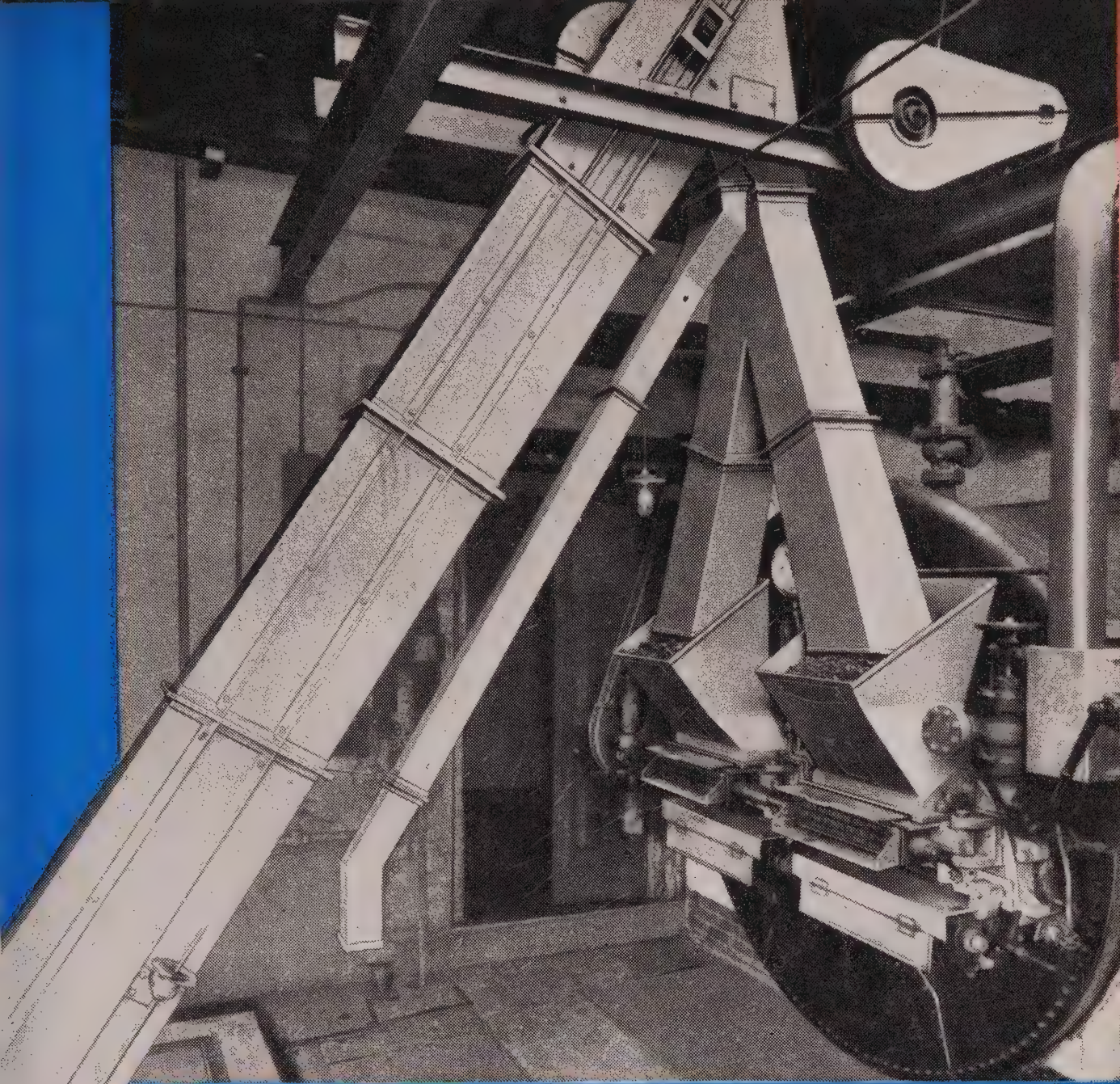
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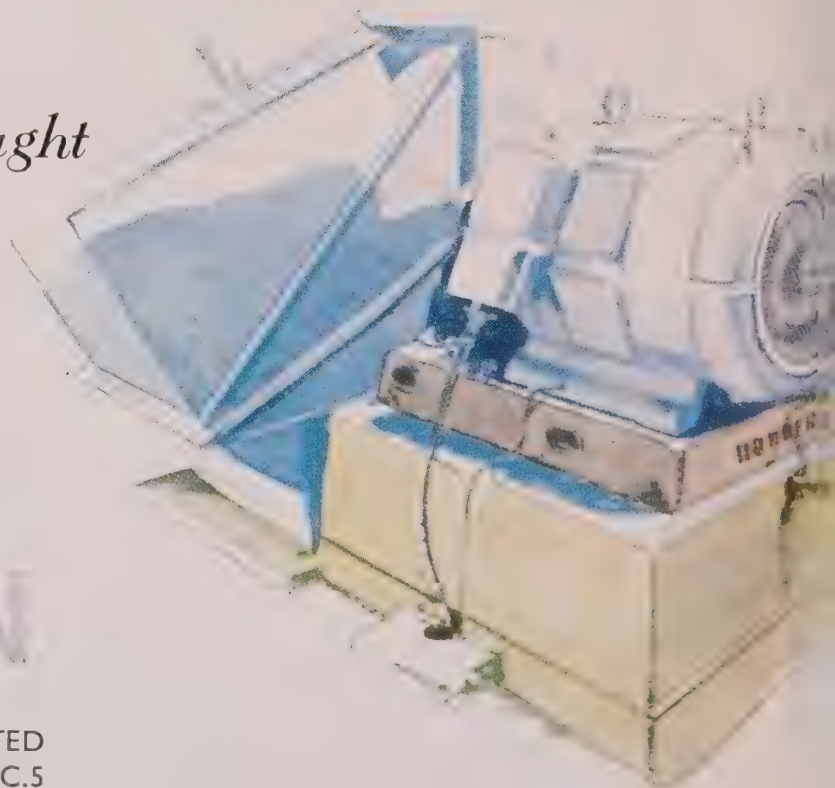
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THE SMOKE ABATEMENT JOURNAL



No. 82

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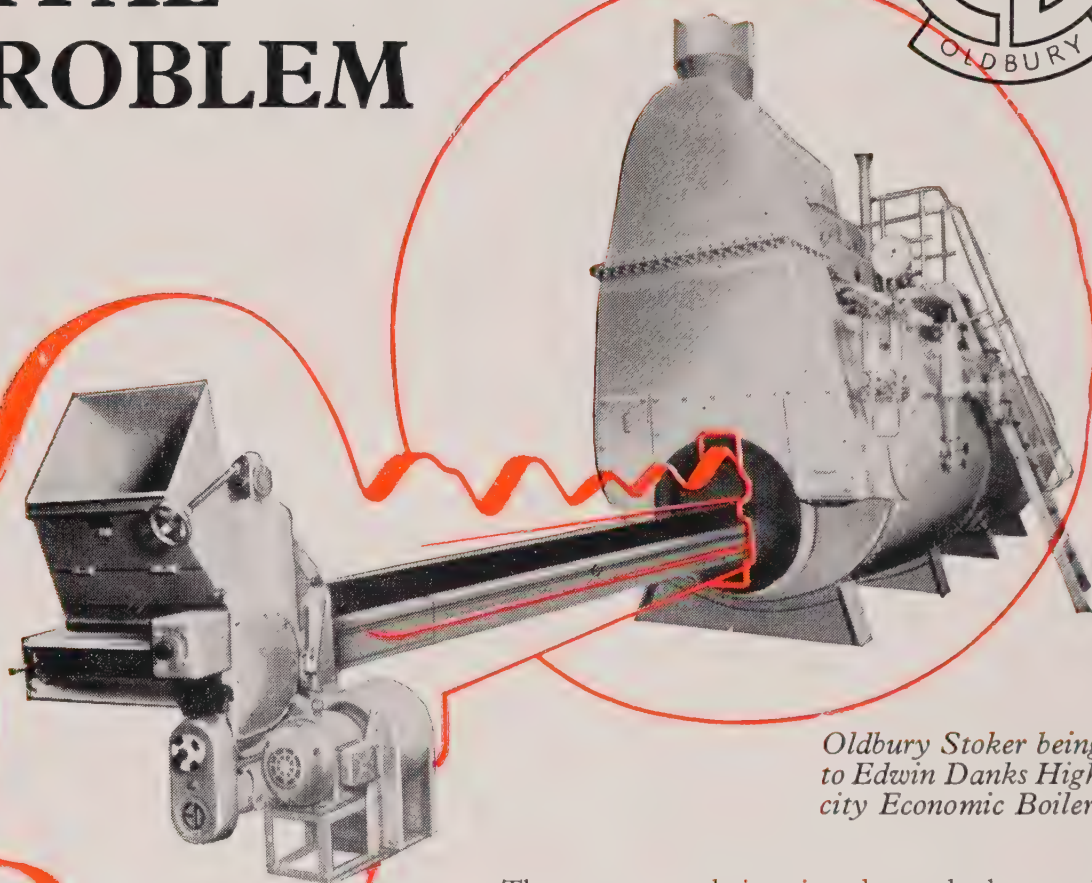
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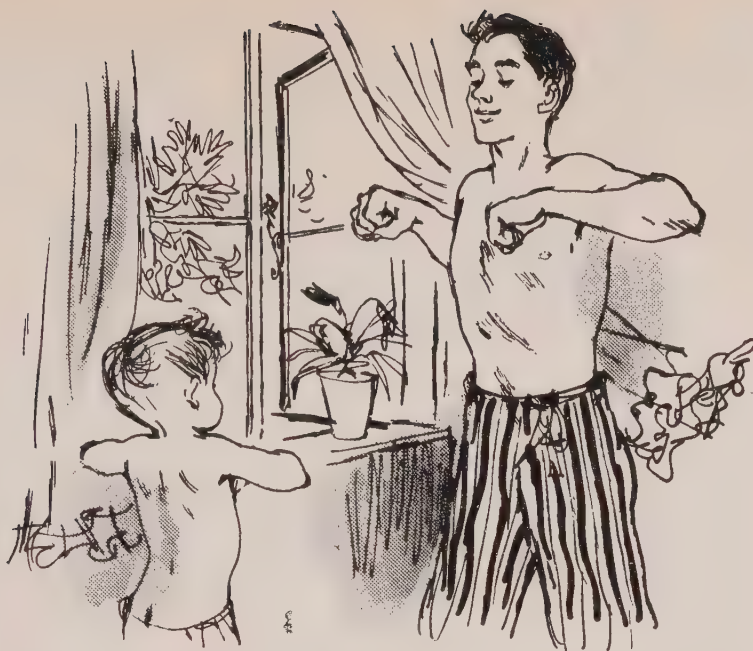
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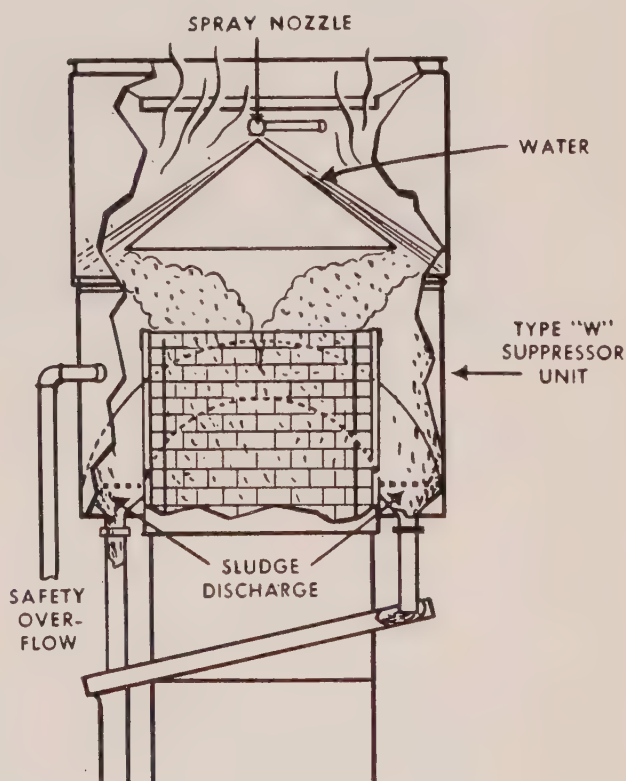
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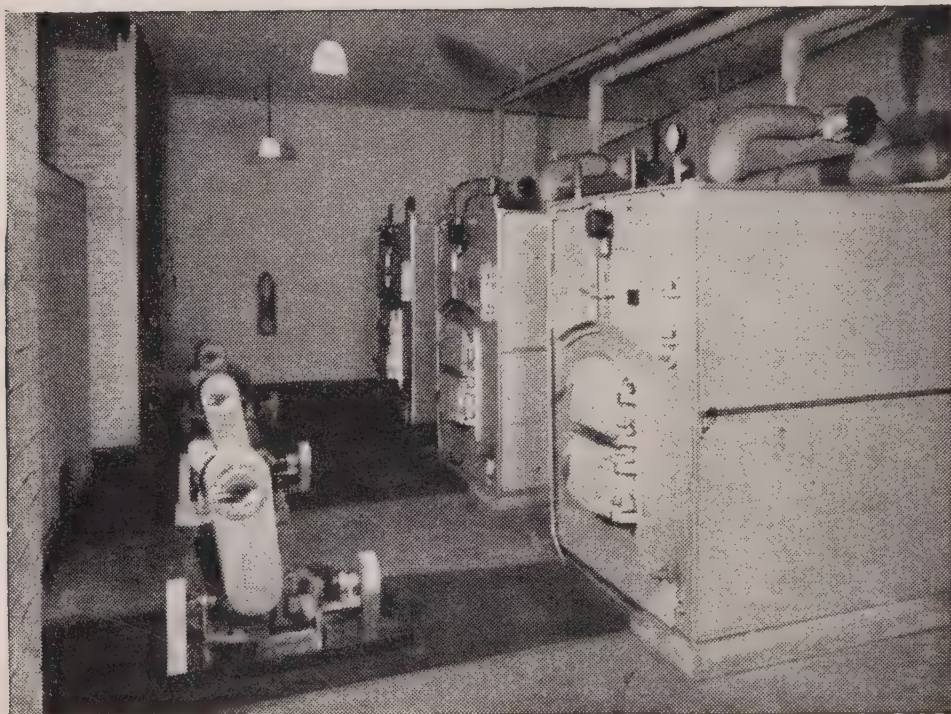
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SMOKELESS AIR

Vol. XXII. No. 82

Summer, 1952

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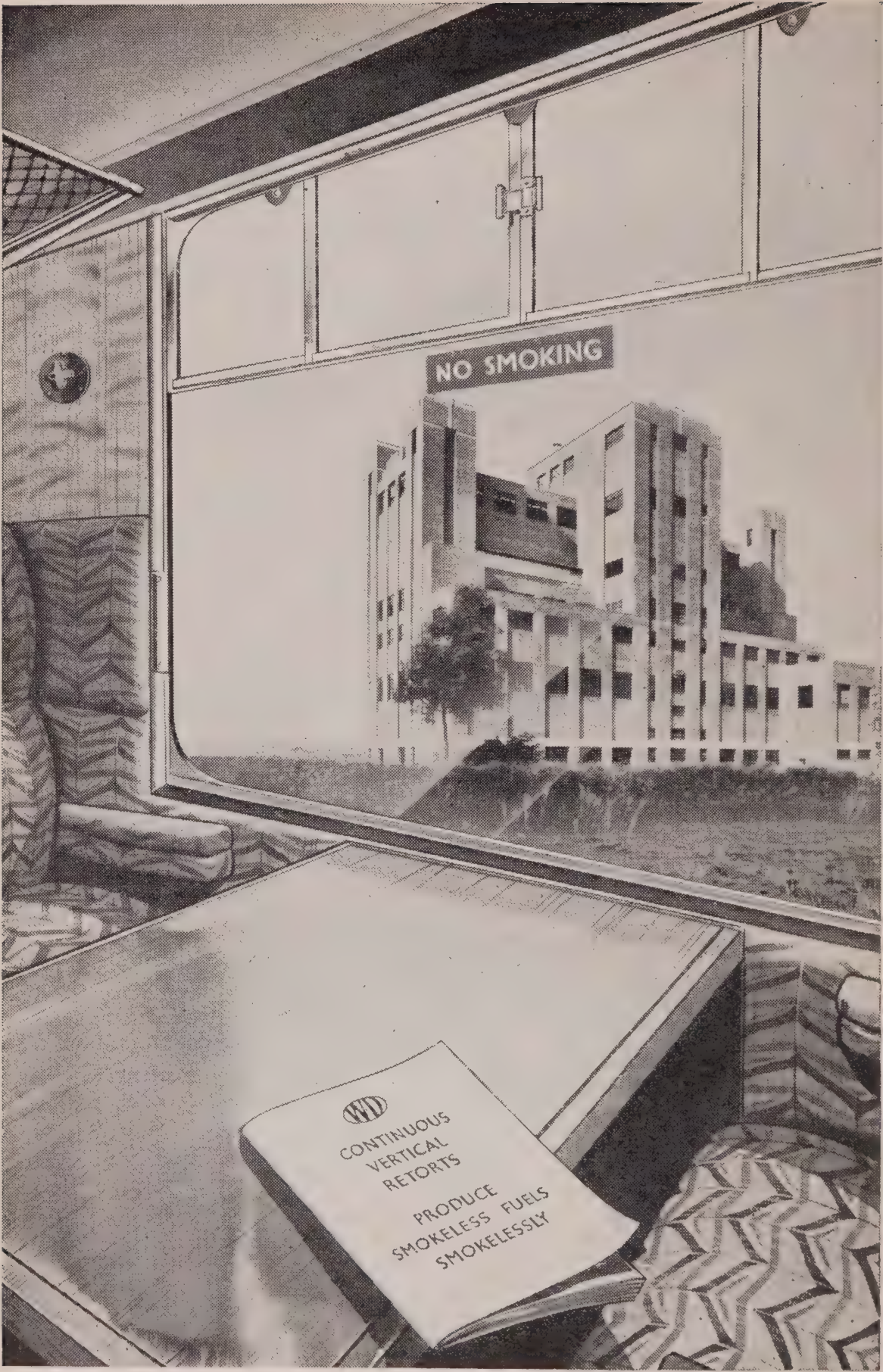
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air*

SMOKELESS AIR

Fuel Policy

Although the Society is vitally concerned, from its own particular viewpoint, in many aspects of fuel policy, it may be useful to emphasize that it must keep outside the ring in the battle that is now waging fiercely over certain issues, and particularly on the use of electricity for domestic heating. Because it is smokeless we would rejoice if it were possible for every home in the country could become all-electric; and we would be equally satisfied if every home could be all-gas, or if the solid smokeless fuels could achieve our aims. The extent to which pro-

gress can be made by these smokeless mediums, and the manner in which that progress should be shared among them, must depend on factors with which it would be *ultra vires* for this Society to be directly concerned. Our chief interest in the controversy is that it is all helping to make people think more about fuel and will bring nearer an active fuel policy that, whatever it may be, can hasten the rate of progress towards the efficient and smokeless use of fuel. And, as was said in the Society's memorandum to the Ridley Committee, we must demand that in any fuel policy due weight must be given to the social costs of the use

or misuse of fuel, among which air pollution is by far the most serious.

The "Times" Letter

Many readers will have seen, or have seen references to, the letter on behalf of the Society that was published in *The Times* on March 4th. It was a candid appeal for support to be given to "this small but experienced and efficient Society," and continued: "Considering that its income has not yet reached £5,000 a year, and that it has a staff of only five, with a London headquarters and six divisional councils, the National Smoke Abatement Society has already done a remarkable amount of good work, and can be relied upon to make effective use of the funds it needs for its educational and propaganda work and services."

The signatories were Mr. S. N. Duguid, Sir George Elliston, Mr. Hugh Gaitskell, M.P., Dame Caroline Haslett, Lord Horder, Sir Edward Keeling, M.P., Dame Vera Laughton Mathews, Lord Samuel, Lord Simon of Wythenshawe, Sir Ernest Smith, and Alderman Professor F. E. Tylecote.

Reprints of the letter have been obtained and are being used with individual invitations to membership. We shall be glad to send a few copies to any reader who might be able to use them.

A Thank-Offering

The letter was discussed with sympathy in a number of technical and professional journals, and we were particularly grateful to *The Medical Press* for its view that "no organization of which we know is today doing work that is directly or indirectly more beneficial to modern city dwellers." It was hoped that their readers—the medical profession—"will not only support the appeal but act themselves as foci of propaganda."

One donation was received with considerable pleasure because it was from a lady in East Anglia who said she sent it as a thank-offering for being able to live in one of the cleaner parts of the country. It is unfortu-

nately only too rarely that an appreciative understanding like this is encountered. Contrast it with the attitude of a local authority which resigned from the Society because—according to the local newspaper—its hard-headed business men members did not consider they were getting value for their money. Considering that smoke is costing the citizens of the town something in the order of £50,000 a year, two guineas might not seem an excessive sum on which to demand quick returns. Fortunately for us local authorities usually take a longer, and less parochial, view of our work.

Those Chimney Fires

One of the many facets of the smoke problem that do not always receive the attention they deserve is that of the deplorable smoke that occurs when a house chimney is "on fire." We were glad to see this problem discussed, with a general article on smoke prevention, in a recent issue of *The Fireman*. Every year, it is pointed out, 20,000 calls to chimney fires are made to the fire brigades throughout the country, and "so long as open coal fires exist there will presumably continue to be this continual drain upon the resources of the fire brigades."

A recent report on chimney fires, by the Chief Fire Officer of Dorset, is mentioned. For an increasing number of such fires this report blames the greater use of wood, especially green wood, the careless cleaning of chimneys, and the faulty design and construction of many chimneys. The report suggests remedies that include thorough cleaning of chimneys by experienced sweeps supervised by the householders; prosecution of offenders where negligence can be proved; better planning of flues, and better workmanship on them.

The Fireman does not mention the deliberate firing of chimneys as a cheap and easy way of cleaning them. There are fewer complaints than there used to be about this anti-social practice, and one wonders if it is still prevalent.

Believe It or Not

To the layman few things can be more depressing than a medical journal containing detailed and cold-blooded descriptions of the deplorable things that can happen to our bodies. The same sort of feeling may be experienced in reading almost any issue of that admirable little bulletin of the Ministry of Fuel and Power, *Fuel Efficiency News*. In this case the reasons for feeling depressed are of course not quite the same, being the accounts that are given of the deplorable ways in which coal can be wasted and smoke nuisance created. We talk about the advances we are making in fuel efficiency, but some of the case-histories recorded make one wonder how deeply this has really sunk.

For example, in the April issue there is an account of the boiler plant at a dairy working at low efficiency and creating smoke. When a visit was made the furnace door was almost red hot and back pressure in the furnace was so great that when the door was opened flames and the products of combustion were blown out. The trouble was soon traced to the fact that the smoke tubes had not been cleaned for over four weeks. The bottom rows were completely closed with ash and soot and the other tubes so nearly choked that only about a quarter of their capacity was free from ash and soot. Now, by proper operation and a daily cleaning of the smoke tubes, the smoke nuisance has been eliminated and a ton of coal a week is being saved! All so simple—and we should be surprised if the management hadn't been blaming it all on the N.C.B. for the quality of coal supplied.

Smokeless Coronation?

When Queen Victoria and the Prince Consort visited Birmingham in 1858 to open the Aston Hall (recalls the *Birmingham Mail*), the people of the city decided that there should be no smoke at all, and made a resolution that no fire should be lighted throughout the day. Only one chimney was

seen to break the rule, and that was at a "necessary waterwork."

Cannot we build on this loyal and ancient precedent and agree that Coronation Day, June 2nd, 1953, be observed throughout the land as a smokeless day? Nothing would be more fitting, on a day given over to rejoicing, and which will need brilliance and colour, than to refrain from obscuring the sun and sky with a pall of smoke. So far, however, this is only an idea. What do our readers think?

Salford's Smokeless Zones

It is disappointing to learn, as we go to press, that the Ministry of Housing and Local Government has refused to confirm the Order for establishing smokeless zones in the city. (A report of the public inquiry appeared in our Winter, 1951, issue). It is understood that it is not considered that the supply of smokeless fuels is adequate. A great opportunity seems to have been lost for a valuable experiment, on the lines proposed by the Simon Committee, even if it had been limited to one zone only.

News Bag

The Newcastle, Australia, Smoke Abatement Panel have been considering asking for the loan of an aeroplane to help them inspect the city's smoke by flying over it . . . Corrosion of T.V. aërials in smoky atmospheres appears to be a new charge to be entered in the cost sheet against smoke, according to a report from Bootle, Lancs. . . . More than 200 well-dressed women at a New York fashion show looked down at their ankles—and found their nylons in ruins. Sulphur fumes from the atmosphere are blamed. . . . The National Coffee Association in the U.S.A. has a smoke abatement committee. The industry soon expects to have at its disposal the means for roasting coffee without adding to the nation's air pollution problems.

A Medical Review of Air Pollution

We publish a lengthy abstract of a survey of the smoke problem from the viewpoint of preventive medicine that is both comprehensive (the original paper contains no less than 95 references) and of importance in its judgments.

The Epidemiology and Social Significance of Atmospheric Smoke Pollution, by J. C. McDonald, M.D.,* Philip Drinker, CH.E.,* and John E. Gordon, M.D.* (American J. Med. Sci., March 1951, 221, 325-342).

The paper first discusses the sources contributing to atmospheric pollution. For at least a century, it continues, investigators have tried to evaluate its alleged detrimental effects of climate, health, animals, vegetation, buildings, and other structures. For the most part investigators have confined themselves to one of these fields. Only rarely have their results been pooled and the total cost of smoke assessed. Very few indeed have appreciated the desirability of evaluating this cost in terms of man's total ecology.

The natural history of every mass disease exhibits constant variations in distribution and frequency in response to continually changing conditions. The epidemic is a relatively bizarre and unusual episode in the course of a disease and quite atypical of the endemic or usual state of affairs. Smog, too, produces its epidemics, the most notorious of which occurred in the Meuse Valley in 1930 and in Donora, Pennsylvania, in 1948. It seems reasonable to suggest that these catastrophes stand much in the same relationship to smoke pollution as do outbreaks of food poisoning to *Salmonella* infection. In both situations, complete understanding is almost certainly dependent upon a study of

the chronic endemic problems.

An epidemiologic problem normally resolves itself into a search for and study of the agent of disease, and secondly an analysis of environmental factors concerned. In the present instance the position is reversed. The start is with a suspected agent to which man, the host, is subjected under a variety of environmental conditions, but with no clear certainty that any disease results.

Objection has been made that smoke produces no disease peculiar to itself, and is but a contributing factor in diseases having other causative factors. This is to lose sight of the ecologic concept of mass disease, that disease is the resultant of many forces that arise variously from a host and from the environment in which the host lives. Multiple causation of origin and course is a principle, applying to all mass disease and mass injury. The direct agent of disease is but one feature of a disease-producing complex that lies within the environment. For convenience it is frequently detached for separate study, principally because that fits so well with clinical investigation based on a specific etiology. Smoke, or any other potential agent of disease, thus expectedly acts in association with many other causative factors, sometimes dominantly and sometimes in a secondary role.

The complex inter-relationship of smoke and environment is considered. The evaluation of the socio-economic effect of smoke, whether by waste of fuel or secondary to its action on the physical and biological environment, presents a difficult and complex task.

* From the Departments of Epidemiology and Industrial Hygiene, Harvard University School of Public Health, Boston, Mass.

Attention should be directed to respiratory disease as the most likely direct effect, though difficulty arises because names of diseases do not always have the same significance to different people at different times and places. It is likely, for instance, that much of the bronchitis of Great Britain would be diagnosed as pneumonia or cardiac failure in the United States.

The constituents of smoke—particulate matter, liquid matter, and vapours and gases are considered in some detail, and reference is made to sulphur compounds, fluorine, and carcinogenic substances. The next section of the paper deals with the environmental determinants, including the meteorological factors.

The direct influence of smoke pollution on human health, by inhalation, is examined and discussed at some length, followed by an account of the relatively few laboratory studies relevant to the subject that have been made.

In an appraisal of the evidence the authors state that no matter how well measured and controlled the evidence bearing on a problem may be, its final evaluation depends on the instinctive conceptions of probability brought to bear by the evaluator. This is largely a function of past experience. No suggestion is intended against striving constantly to obtain mathematical statements of probability with their limits of possible error. What is said is indeed in vindication of such efforts, which aim at reducing the personal factor to a minimum. It is justification, nevertheless, for the attempt now made with the meagre and often insufficiently controlled evidence that exists, to evaluate by reasoning, logic, and experience the direct influence of atmospheric smoke pollution on human health.

The case against smoke stands or falls by its effect on the respiratory tract. That is where we would expect its results, and that is where diseases of the sort we would expect do occur.

The strongest evidence is probably supplied by the episodes of association between severe fog and high death rates from respiratory disease, but so far we have no way of separating the influence of a period of high concentration of smoke from the influence of the environment which determines that concentration. It seems unlikely indeed that the smoke content of fog plays no part whatever in producing the illness and deaths which accompany it; and it seems probable that it plays a major part.

If it is admitted that severe smoke pollution can be one of the causes of death from respiratory disease, then it follows reasonably that lesser degrees of pollution are likely to cause pathological results of less severity. Although the highest concentration of any irritant gas ever encountered in the atmosphere is much lower than that required to do any harm to animals or man under controlled conditions, it should be remembered that multiple causation is the rule in natural disease. Any search for a single responsible agent of itself alone responsible for a morbid process is likely to be doomed to failure. Smoke itself is a mixture of many potential agents and it seems reasonable to expect some degree of synergistic action both between them and between infective and climatic factors. The carcinogenic activity of atmospheric smoke must be left as an open question.

In conclusion the authors suggest lines for further studies in the field of epidemiology: the best use should be made of available data; laboratory studies should be made to assess the important question of synergism and antagonism among components of smoke, etc.; and lastly field studies of specific population groups would yield information on the range of variation of susceptibility of human beings to the effect of certain irritants and of factors which influence it.

The significance of atmospheric
Concluded on page 157

Air Pollution and Plant Growth

By

J. K. A. Bleasdale

(*Department of Botany, University of Manchester.*)

THERE are many reasons why smoke should be eliminated from the air. Black smoke is the product of inefficient combustion which neither man nor industry can afford.

It is rarely that the manufacturer considers the effects of the smoke from his factory on the well-being of others, and usually the only concern of the domestic user of coal is to make sure that the smoke goes up the chimney. Corroding and blackened buildings are accepted by the town dweller as almost inevitable—the “where there’s muck there’s brass” philosophy.

Plant growth is the source from which all our food and a lot of our pleasure are derived. The well-fed animal and the ripening field of hay are the pride and income of the farmer. The well-kept park or garden is the delight of those suffering from a surfeit of bricks and mortar. Let us consider the effects of air pollution on plant growth.

For good growth a green plant needs light, water, air and soil; these factors can be shown to be directly or indirectly affected by air pollution. A smoke pall reduces the light intensity, and soot deposited on leaves further reduces the light available to the plant. Little is known of how air pollution affects the soil or how toxic substances carried down in rain may affect plants. It is generally supposed that the acid gases dissolved in the rain will leach out the soil bases and hence increase the need for lime in areas where pollution is at all heavy.

Does the gaseous part of coal smoke pollution affect plant growth? For the past three years I have been

carrying out experiments designed to enable me to answer this question.

Sulphur dioxide, formed from the sulphur in coal, is the principal gas that pollutes the air in industrial areas. No matter how efficient the combustion or how efficient the removal of smoke particles, this gas is released into the air when coal or fuels derived from coal are burnt. Approximately four million tons of sulphur dioxide are released into the air over this country in one year.

The problem of the effects of sulphur dioxide on plant growth is not a new one. Examination of the published work showed however that there was a serious discrepancy between the findings of those who had studied the effects of air pollution¹ and those who had studied the effects of sulphur dioxide² on plants. It was generally maintained that sulphur dioxide in concentrations not producing leaf lesions did not affect plant growth, i.e., concentrations below 40-50 p.p. 100 m., though some workers who have observed the effects of air pollution on plants have suggested that even without leaf lesions being produced, air pollution does adversely affect plant growth.

In my experiments two air-conditioned greenhouses were built so that one greenhouse received air polluted with coal smoke and the other received similar air after the polluting gases had been removed. A series of controlled experiments revealed that polluted air can reduce the growth of ryegrass by about 50 per cent. This figure is only approximate as the magnitude of the effect depends to some extent on other environmental conditions. Perhaps the best way of

expressing the effect of air pollution is to relate it to the effect of mineral fertilizers. It was found that plants grown in purified air in a soil of low fertility gave as high a yield as plants grown in polluted air in similar soil plus a liberal dressing of fertilizers.

Ryegrass was chosen as the main experimental material because it was the supposed effects of air pollution on this species in East Lancashire that prompted the research. Farmers found that after ploughing up their pastures and reseeded them with this grass they were not getting the expected increase in carrying capacity. It was suggested that the smoke from the mill towns might be responsible for this.

It seems evident from the results of experiments carried out in the greenhouses that sulphur dioxide is the gas responsible for the adverse effect of the gaseous pollution on plant growth.

This is apparently contrary to the findings of all previous workers but a close study of the literature reveals

that previous workers have not treated plants with sulphur dioxide long enough to produce an effect on growth.

The experiments at Manchester have so far been carried out on only a few plant species, but a theory has been developed that suggests that the effect of air pollution is upon the physiological regulation of growth and hence all species would be expected to be affected to some extent.

Air pollution gases, in concentrations not producing leaf lesions, do have a serious adverse affect on plant growth. Effects without leaf damage are difficult, if not impossible, to detect without conducting carefully controlled experiments. It is thus possible that many farmers are suffering loss as a result of air pollution and do not realize it. Large areas of farmland in Lancashire and Yorkshire are subjected to air pollution and consequently the value of an important potential source of food supply is seriously impaired.

The effects of coal smoke pollution

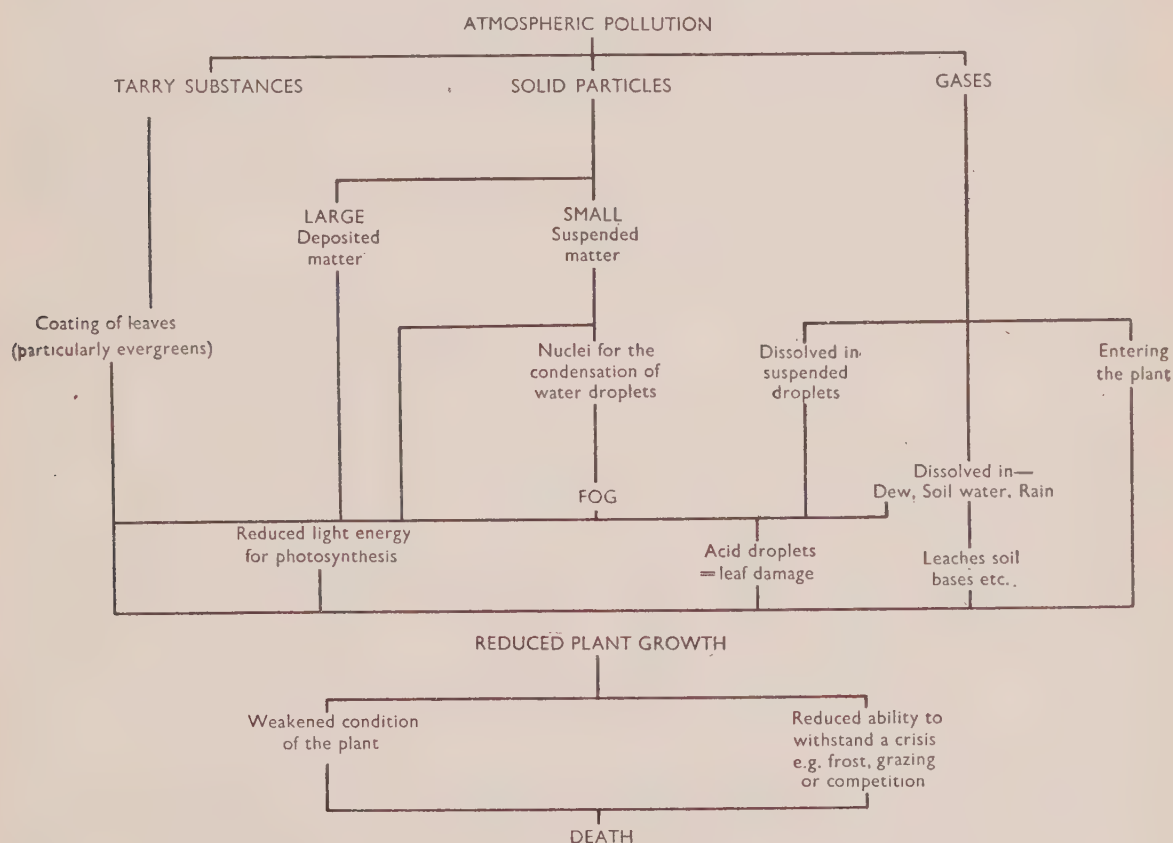


Fig. 1

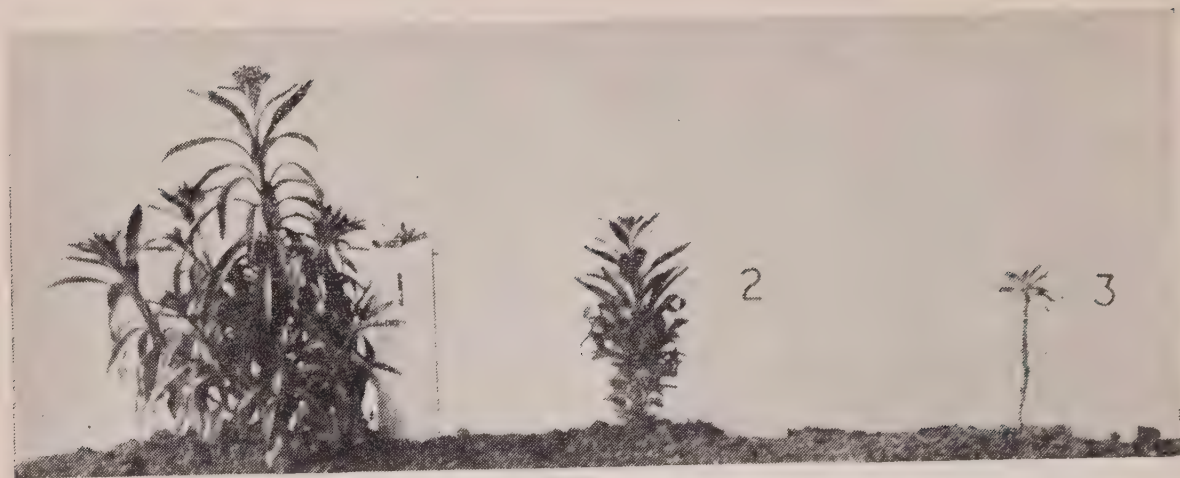


Fig. 2. Typical plants of wallflower. (1) from pure air; (2) from moderate pollution; (3) from heavy pollution. Transplanted to the plots on September 3rd, 1951, and photographed March 31st, 1952



Fig. 3. Typical plants of spring cabbage. (1) from pure air; (2) from heavy pollution; (3) from moderate pollution. Transplanted to the plots on November 1st, 1950, and photographed on April 18th, 1951

gases on plant growth makes even more undesirable the release of valuable sulphur into the air.

The relationship between air pollution and plant growth may be represented schematically as in Figure 1. The effects of pollution on plants is far more severe during winter than during summer, and hence species that are not dormant during the winter suffer the most. Amongst such species are wallflower, spring cabbage, and ryegrass.

Field experiments were carried out using these species and others. Plots of similar soil were constructed at places receiving different levels of pollution. The plants were established

in the autumn and typical plants were photographed the following spring (see figures 2, 3 and 4). Many of the plants at the heavily polluted sites did not survive the winter. Forget-me-not will not over-winter at all under conditions of heavy pollution.

An important factor affecting the winter survival of the species mentioned above is that air pollution increases the rate of leaf senescence. A plant depends upon its green leaves for the manufacture of its food, so that if leaves die faster than they are replaced the plant loses its ability to manufacture food and consequently dies. The rate of production of new leaves is low during the winter be-

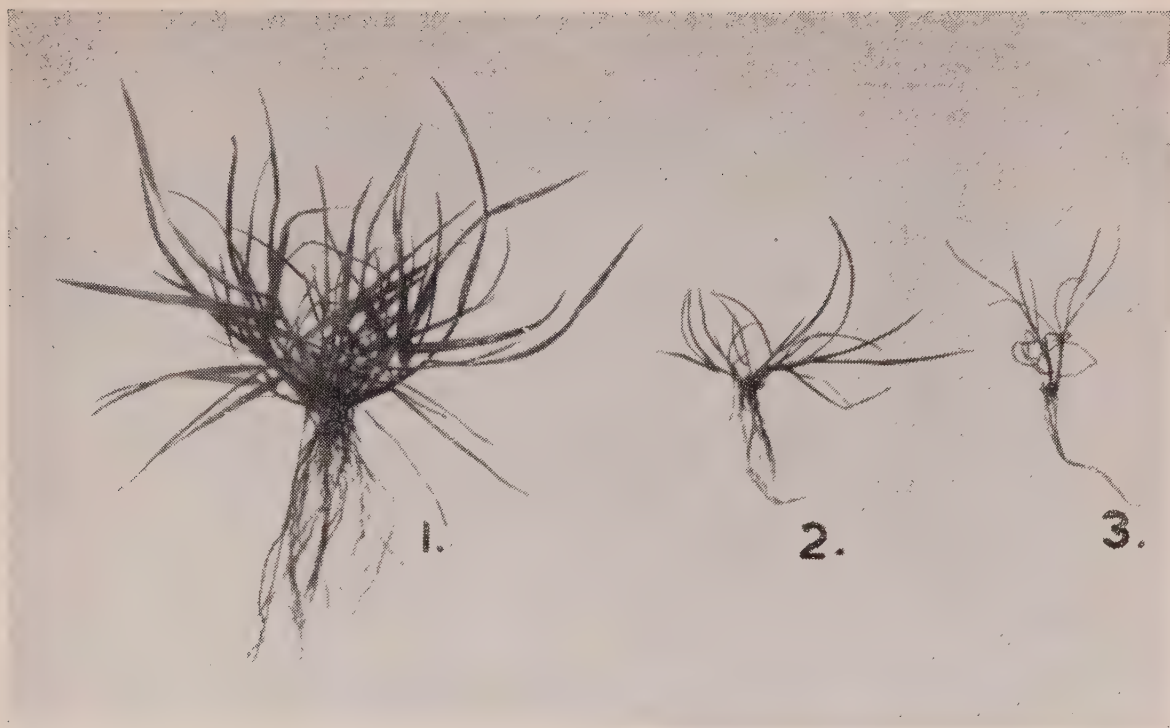


Fig. 4. Typical plants of *S.23* ryegrass. (1) from pure air; (2) from moderate pollution; (3) from heavy pollution. Transplanted to the plots on November 1st, 1950, and photographed April 19th, 1951

cause of the low light intensity and the cold, and hence in heavy pollution the plants very often die because the older leaves have senesced and no young ones have replaced them.

Air pollution is thus very deleterious to plant growth and as a consequence the upkeep of parks in towns is made more costly and the production from farmland adjoining industrial areas is reduced.

I wish to acknowledge the grants

made by the Agricultural Research Council and Manchester City Health Department that have made this work possible.

References

¹E.g., Cohen, J. B., and Ruston, A. G. (1911). *Smoke: a study of town air*. London: Edward Arnold. 88 pp.

²E.g., Thomas, M. D. (1950). Gas damage to plants. *Ann. Rev. Plant. Physiol.* 2. 293-322.

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smoke pollution is to be found by weighing the damage done against any associated benefits and the cost and efficiency of any control measures. The balance may be struck in a variety of units—dollars, man hours, death or disease—and preferably in as many as are feasible, because it is not easy to establish their “rate of exchange.” Initially, some of the estimates may be appallingly crude and rough and possess a wide range of possible error, but only through increasingly refined estimates of total

cost can a sound evaluation of smoke control, or of any other public health activity, be made.

ODOUR ABATEMENT

A step towards the control of odours is reported from the United States. The Franklin Institute of Philadelphia has designed an apparatus by means of which samples of air can be liquified and the liquid then analyzed by using an infra-red spectrometer which makes possible the identification of certain malodorous compounds.

Portsmouth Conference in September



JACK ABRAHAM.

THE Society's 1952 Conference will open at Portsmouth on Wednesday, September 24th, and will close on the afternoon of Friday, the 26th. The programme has now been completed, and it looks as if we shall see a conference as interesting and as useful as any of its predecessors.

First, on the Wednesday morning, is the official welcome by the Lord Mayor of Portsmouth, and then Professor Tylecote's Presidential address. In the afternoon comes the third Des Voeux Memorial Lecture, in which Mr. W. R. Hornby Steer will survey, in a broad and comprehensive way, the question of smoke prevention through legislation—past, present, and the possible future.

The Thursday morning session will be devoted to "Progress Reports." There will not be as many as on the last occasion—at Harrogate in 1949—but they will be of major interest and should ensure good discussion. Dr. Burn of Salford will report on smokeless zones, Mr. Goodfellow of Leeds on prior approval progress, and a Fuel Research Station representative on research into the problem of removing sulphur from flue gases. There will be a report on the new local Consultative Committees, to be given by a representative of the first of these

Committees, Widnes. There may also be other reports on subjects of special importance.

Thursday afternoon will be concerned with "Incentives for Smoke Prevention," covering both incentives in industry and the home. For industrial incentives the speaker will be Mr. W. L. Mather, and for the domestic side the paper will be by Dr. Martine of Birmingham. Although Mr. Mather will no doubt deal with incentives for boilermen and stokers, their point of view will also be given by Mr. W. Tudor, Secretary of the Power Workers' Group of the Transport and General Workers' Union. A lively discussion seems certain.

On Friday morning iron and steel problems will again be discussed on a paper to be given by one of the leading authorities in the country, Professor R. J. Sarjant of the University of Sheffield.

Finally, on Friday afternoon, will be visits to H.M. Dockyard, with an inspection of H.M.S. *Victory* and possibly also to a modern warship. Alternatively, members will be able to inspect the power house of the city's sewage outfall station, which is renowned for being operated by one of

(Concluded on page 161)

Central Manchester is Smokeless

“Point of Departure”

MAY 1st, 1952, saw the coming into force of Section 35 of the Manchester Corporation Act, 1946, as a result of which the central area of the city becomes a smokeless zone. The first smokeless zone is, of course, that in Coventry, which has now been in existence for over a year, but with Manchester remains the honour of being the first local authority to investigate the possibility of smokeless zones and the first to secure the necessary legislation.

The Manchester zone covers 109 acres, and for those who know the city it is the area bounded by Deansgate, Market Street and Piccadilly, Portland Street, Oxford Street, and Peter Street. When the area was re-surveyed three years ago there were 2,128 open grates in use, all but twelve of which were burning bituminous coal.

What is particularly interesting about the coming of the Manchester zone is the considerable amount of excellent and helpful publicity it has been given in the local press, and to some extent also nationally and on the B.B.C. An accurate article on the subject appeared in the *Manchester Guardian* of April 29th, and we cannot do better than to quote direct its references to the policy of the City Health Committee that has culminated in the establishment of the zone successfully and without friction:

“The Manchester Health Committee was anxious to avoid arousing prejudice and hostility against the smokeless zone policy by premature enforcement, for the essence of that policy is the progressive extension of the smokeless area until it covers the whole city. A smokeless central area is valuable only as a point of departure, and to succeed in its early establishment at the cost of forfeiting the goodwill of the

electorate and the co-operation of the occupiers of premises in contiguous areas would have been to fail in its ultimate purpose. The committee therefore decided to wait until a more plentiful supply of smokeless fuel enabled it to use its powers without making unreasonable demands on firms occupying ill-equipped premises on short leases.

“This decision has been amply justified. The committee’s staff of smoke inspectors is far too small to permit individual contact with the occupiers concerned, but there has been a ready response to the Chief Sanitary Inspector’s invitation to them (incorporated in the statutory advertisement published a year ago and recently repeated) to consult him about any difficulties that may arise. In some cases a senior inspector has been sent to give advice on the spot. Many inquirers have been enthusiastic, and all have been amenable; there has been no sign of protest or recalcitrance.”

A further account in the *Manchester Guardian* suggested that there was some doubt about who first conceived the idea, and how it was first made known. The Society’s press-cutting records clear up any doubts, and it may be useful to summarize the facts. The first mention in the press of the proposal was in the *Manchester Evening Chronicle* of February 14th, 1935, and in the *Manchester Guardian* of the following morning, reporting a meeting of the Manchester and District Branch (as it was then) of the Society, at which Mr. Charles Gandy has said that he had recently written to the Minister of Health, Sir Hilton Young, suggesting that smoke should be prohibited in small selected areas in the cities. “We have silence zones under Mr. Hore-Belisha,” Mr. Gandy



Manchester's central area—a few days before May 1st, 1952

(Photograph by courtesy of the Manchester Guardian)

was quoted as saying, "and I do not see why we should not have smokeless zones under Sir Hilton Young."

This remark shows how the idea, and the name (which at once "caught on") first came to our late Chairman.

In a letter to the *Manchester Guardian*, published on February 15th, 1935, Mr. Gandy pointed out that he had written privately to the Minister, and that smokeless zones were not, as yet, the official policy of the Society. (It was not long, however, before they were.)

Next, on April 25th, 1935, the *Guardian* published a long and able letter from Mr. Norman McKellen, Chairman of the Manchester Ratepayers' Council, in the course of which he gave support to the idea of smokeless zones and advocated one for the centre of Manchester. In his letter Mr. McKellen detailed a suitable area for the first zone in the city—suggestions which correspond closely to the area that is now actually the central smokeless zone. One recalls how delighted Mr. Gandy was to find such

support outside the Society's own ranks, and Mr. McKellen was a member of the delegation from the Society that, three years later, met the Manchester Health Committee to make formal proposals for surveying the area and obtaining powers to make it smokeless. Mr. McKellen became, and still is, a member of the Society, and he must be gratified to see, at last, the smokeless zone he advocated come into being.

Smokeless Zone is News

There is no doubt that there is news value in smokeless zones—and this, to the Society, means educational value. The accompanying *Manchester Evening News* photograph is reproduced to show one way in which the Manchester press made the public aware of what was happening. The *Manchester City News* published an enthusiastic leader, which said:

"Dreams come true! Lost causes won at last! For decades the pioneers of smoke abatement pleaded by logic, ideals and practi-



How the "Manchester Evening News" publicized the coming of the smokeless zone — a photograph showing an office worker stoking her (very!) old-fashioned coal fire for the last time

cal illustrations for the smokeless city. This newspaper since its inception has never wavered in its advocacy of this cause . . . Yes, May Day will be a Red Letter Day. A salute to the sun. There should be a procession of little children celebrating the victory of the sun and the defeat of smoke. For sunlight and pure air are the heritage of little children . . ."

The *Sunday Chronicle* began an article on a lighter note:

"In the attics of Brown Street, Manchester, the office occupants were yesterday shovelling coal on their fires with a lavish hand and muttering 'Got to get rid of it somehow'."

And later in the same article:

"At the Coal Board offices in Portland Street, life went on as usual. Officials continued to sell coal to their customers sublime in the knowledge that their own offices were centrally heated by gas-fired boilers."

A *Daily Dispatch* reporter went round looking for smoke—and found a public house offending. The *Evening News* has already looked ahead—exactly as we have hoped those in smokeless zones would do in time—by pointing out that a single smokeless

zone is not enough. "Smoke abatement will work when it is universal . . ." But, it agrees, a start must be made somewhere.

One of the arguments for smokeless zones has been that they would bring home to the public the reality of smoke prevention—no longer would that phrase be a worthy but airy and abstract idea. The correctness of this argument, which was one that Charles Gandy used in his persuasive and convincing way, is now becoming apparent. Our one regret is that he did not live to see his dream come true.

Portsmouth—concluded

the very few surviving beam engines.

There will, of course, be social events—a reception on the Wednesday evening by the Lord Mayor, and the Society's own informal "evening party" on the Thursday.

The meetings will be held in the South Parade Pier, Southsea, near to most of the hotels and boarding houses, and directly opposite the headquarters hotel, the Royal Beach.

Invitations to the conference have been sent out to all members and representatives and will be sent to any other readers on request.

CLEANING OUR AIR

by

Robert T. Griebeling

Executive Secretary, Air Pollution and Smoke Prevention Association of America.

For two main reasons we are glad to publish the greater part of an address given by Mr. Griebeling to the 46th annual meeting of the Smoke Abatement League of Hamilton County, at Cincinnati in February last. First because of the picture it gives of some of the problems facing our American friends, and secondly because the author, who came to smoke prevention from publicity and public relations work, has much to say that can be applied to our efforts in Britain.

A CLEANER air movement was probably initiated as early as 6,000 years ago when people were inconvenienced by the smoke and the noxious odours rising from the foundry of Tubal-cain. With anti-smoke activity thus dating back to the dawn of time, it would seem as though little progress has been made, particularly when one looks out of the window and contemplates a neighbouring factory's belching smoke stack.

As a matter of fact, a great deal has been done, not only in the western hemisphere, but also in many countries of Europe. In the case of our Association, if we take only the activity that has been recorded in the past 45 years, we will find nearly 700 articles, given at our annual meetings, which are concerned with the reduction of smoke and other air pollutants. These papers—and they're only a drop in the bucket of the very extensive air purification literature—were prepared by persons who cared for clean air tremendously, so much so that many of them spent their entire lives in the cause of air pollution control.

With all this overwhelming evidence, the movement for cleaner air is one of the things the general public should be most aware of. Unfortunately, this

is not the case. Pessimistically I say that the public in general is just about as aware of the activity in the reduction of air pollution as it is about the physical details of its body, of which, as we know, most people are grossly ignorant.

This state of things, however, cannot be blamed on the public. It has always been eager for knowledge, even though this may have to be provided in sugar-coated form. If the public is completely unaware of a certain subject, this is no doubt the fault of those who should know better.

In air pollution control work we have any number of technically trained personnel; any number of municipal officials; and a large number of scientists. What we don't have, and what we need very much, is a growing number of publicists, both professional and amateur, who will keep the public informed as often as necessary about various phases of control work.

The efforts of those engaged in reducing air pollution should be told whenever possible. Keeping the public informed keeps the public educated. When the public is educated it understands. And an understanding public will make the work of us in air pollution abatement so much easier and more fruitful.

Giving out information about our work can be done in many various ways: by word of mouth before clubs, service organizations, and churches, as well as by interviews on radio and television. It can be done by newspaper and magazine articles, and with motion pictures.

The Press

In my long experience with editors, I have found that they are always

glad to co-operate in the publishing of worthwhile news. If they seem uninterested, you can bet your bottom dollar that the subject has not been presented to them properly, or that there was some mechanical reason why the material could not be published at a given time. News value is most important.

Members of the press make their living by providing readers with interesting news. They gather so much of it during the day that only a fraction ever sees the printed page. An editor, in addition to being a professional gatherer of news, also serves in the position of an enlightened civic leader who is constantly fighting for the improvement of his community in one way or another.

He is always interested in a cause. Causes, if properly presented, will receive very good—if not preferential—treatment at his hands. He fights scandal, exposes corruption, and prods civic laggards into action. He is a tremendously necessary individual in any community.

The reduction of air pollution in our community life is one of the finest causes to which citizens can dedicate themselves. The ultimate result of their activity adds up to cleaner surroundings and a happier living. Such a cause is one which will enlist the aid of an editor very easily, and should therefore enjoy wide publicity.

This has not too generally been the case. Making such a statement in Cincinnati smacks somewhat of an untruth, because your very Smoke Abatement League has been vigorously fighting unclean air just short of a half a century. Your smoke control division is peopled by intelligent administrators and staff men. Your newspapers are all equipped with what we in Pittsburgh jokingly call "smoke typewriters"—machines especially oiled and ready to turn out excellent anti-smoke and air-pollution stories.

Cincinnati, the country had its eyes on you last fall when you again spearheaded the drive for cleaner air! The way the Cleaner Air Week promotion

was handled by the newspapers here was little short of astonishing. The people of Cincinnati can thank their editors for such able support.

Anti-air pollution has not fared so well in other cities, and the blame can be laid squarely at the door of (1) the air-pollution control official and, (2) the industrialist.

The Municipal Official and the Industrialist

The municipal official is often so close to his work that he does not see the forest for the trees. Furthermore, he may not be what is known as news-minded. And then, he may think some phases of his work dull and uninteresting to the public. He may not have the contacts he should have with the newspapers in order to assure proper publicity for his department at frequent intervals.

He further may not have the complete confidence of his own city administration. I know of one specific case where the administration, attempting to curry favour with offending industrialists, desires to keep its air-pollution control official under wraps, and constantly minimizes the very good work this man and his department are doing.

Such an attitude is fostered by a narrow political outlook. The administration, for the sake of not offending the violators, preferred to shroud the whole operation in oblivion.

The industrialist's trouble is that he may see too many ghosts. He fears the press, and so his defence mechanism goes to work. He is afraid of poor reporting or distortion or bad headlines. Sometimes, because of his attitude, he unnecessarily complicates otherwise simple matters.

He may have creditable air-pollution control installations in operation; yet, because he has not completely equipped his plants, he is afraid the finger of adverse publicity will be pointed at him emphasizing his omissions rather than his accomplishments.

You and I know that isn't right. We must take our chances, and chances are that things will turn out quite



Robert T. Griebeling

beyond expectations. To such an industrialist I would like to quote the Scriptures and say: "Let your light so shine before men that they may see your good works!"

The industrialist should be proud of the things he has already done—a little boasting won't hurt—and his actions may lead others to pull their light out from under the bushel. Thus the first man, by setting an example, would be doing much service to his community in the cause of cleaner air. Good communal relations are of high value to all manufacturers.

Those of us in air-pollution control work know that the road ahead is difficult and long. Enthusiasm, balance, co-operation, indulgence, and unlimited amounts of patience are necessary before each little forward step can be taken.

And you can't do it without money. The Committee on Smoke and Fumes of the Western Oil and Gas Association spent \$1,000,000 in the past five years financing research on the Los Angeles smoke problem. A similar amount is being spent for the comprehensive area-wide air pollution study sponsored by the Technical Advisory Board of the International Joint Commission in Detroit.

Some Instances

The battle against smoke has been won in many communities, but the longer and more difficult task of combating other air pollution lies ahead for most industrial cities.

St. Louis is being pointed out as one of the larger municipalities that has done an excellent air-pollution control job. May I remind the audience that anti-smoke agitation in St. Louis began in 1862—just 90 years ago!

St. Louis' first smoke ordinance was passed in 1892, and 34 years later the Citizens Smoke Abatement League was formed. The first effective action, as far as legislation with teeth in it was concerned, was taken in 1937. Much reduction of smoke from many industries and commercial chimneys, as well as railroad yards, was brought about in the first two years of organization by this group.

Yet winter smoke palls continued, and the Smoke Control Division was berated by the public for "doing nothing."

Life magazine, in its January 15th, 1940, issue, published photographs of St. Louis, and called it a "city of decay." It is not my intention to discuss the St. Louis case in detail. You are all familiar with what happened a few years later. The transformation was astounding, and *Life* was square enough to record the remarkable change photographically.

Pittsburgh is another city to which people point with pride for the way it cleaned its air. But more than 10 years were to pass before the desired changes were brought about—even with the prodding of an enthusiastic citizens' committee, a willing and co-operative industrial attitude, and a fervent city administration. Mellon Institute, in which the Secretariat of the Air Pollution and Smoke Prevention Association is housed, laid the research ground work.

The war held Pittsburgh back, but the subject was revived in 1946, and legislation forbidding the random firing of high-volatile coal was enacted.

Residents who formerly burned high volatile coal profusely and wastefully now had to buy a special coal, or special mixes, which could be burned smokelessly. This, when Pittsburgh is built practically on top of the finest high-volatile coal in the world!

Others converted to gas when this fuel became available on a large scale. As a result, the community is no longer hampered by the dense smogs that formerly settled all over it.

Los Angeles is very much concerned about its air-pollution problem. Here we have a larger, teeming industrial city that grew to its present size as a result of the war. It suffers from poor geographical location. The city is on the Pacific Ocean, hemmed in by a range of mountains to the east. During the day, the prevailing winds come from the ocean and blow the polluting matter away from the city toward the mountains. At night, the direction of the wind is reversed. The pollutants are carried over the city and out to the ocean, but of course some find their way down to the ground and become nuisances. The next morning the sea breeze blows the polluted air back over the city, and so on, *ad infinitum*. In other words, the city does not only suffer from an initial pollution, but from repeated doses having the same origin.

The newspapers in the cities just mentioned have long ago been made aware of conditions, and have co-operated wholeheartedly. This is again due to the fact that intelligent technical people supervised the education of the reporters.

This is not always the case. One city I know of, which is currently in the throes of trying to clean itself up, is having tough sledding. Certain emotionally unstable residents, as well as unscrupulous and selfish officials, have led the newspapers by the nose and have given the bureau of smoke control a very trying time.

They insist that the bureau is unwilling to crack down on violators. This word violators should be in quotation marks, because the principal

target of these hysterical citizens is an organization which has already spent many millions of dollars in air-pollution control equipment alone. The firm has been concerned with the problem of abatement for 50 years. It has co-operated loyally and civically, but the dissidents merely call this lip service.

Here, of course, is publicity, and plenty of it, but it is of the kind that beclouds rather than enlightens. The damage that is being done by certain unprincipled persons to the education of the public may take years to correct. I am not mentioning the city by name because our Association does not believe it should mix into local affairs. The problem is serious, but now, eight months after the quarrel began, the soberer elements in the community seem to have regained the upper hand.

Interest in air pollution control is increasing with every passing week. We have on our Association mailing list about 200 names of city officials in the United States and Canada who are concerned with abatement. I think this is a very good showing and the list will no doubt increase in the future as more communities begin to take action. The cities that are clean today want to stay clean, and they are taking steps to regulate the industries that are either coming into their areas, or else those that are already there.

There is a veritable thirst for more information about air-pollution control work. The other day we received a letter from the head of a recently formed air-pollution control division in Buenos Aires. He plans a trip to the United States to study control programmes at first hand, and he wants us to map out his itinerary for him.

We have also been in communication with interested persons in Australia, New Zealand, France, Belgium and Norway. Our relationship with the National Smoke Abatement Society of Great Britain is on an excellent basis, and hardly a month goes by without the exchange of several letters between our Secretariat and the executive officer of that society.

We invited the editor of *Smokeless Air*, the publication of the National Smoke Abatement Society, to prepare articles on British phases of air pollution control for *Air Repair*, our magazine. The editor accepted, then asked us to keep him similarly informed as to developments in the United States and Canada.

While the movement toward cleaner air is constantly growing, there is one phase which is lagging—a subject which should be a cause for concern.

I am referring to the salaries paid by many cities to air-pollution control officials. They are far too low to attract the type of talent which is necessary for efficiency. Most cities, fortunately, are blessed by having men

of high calibre and fine backgrounds heading their air-pollution control activities. These men, dedicated to their task, serve at remunerations which would be considered mere pittance by many in industry. Is this the reward our communities give to those who forego the greater stability of industrial employment?

The condition, we firmly believe, will be corrected by many local administrations. Every day their attention, in one way or another, is being focused on the need for air pollution control and for competent and capable men to enforce it. Since this is the case, I am optimistic. We're going to get cleaner air, come what may!



From our Photo-Library—13

Business Centre

(A close-up in what is now Manchester's Smokeless Zone)

NEW PUBLICATIONS

Fuel Research, 1949-50 (Dept. Scientific and Industrial Research, H.M. Stationery Office, pp. 60, 2s. 6d.) is the latest report of the Fuel Research Station. It will be of interest to readers of this journal, not simply for its section on the investigation of atmospheric pollution, but because of the bearing that so much of the other work being done at Greenwich has upon the prevention of pollution. In particular, the chapters on boilers and steam raising and on domestic heating are of direct interest, while less directly there are chapters on the carbonization of coal, gasification, pulverized fuel, and coal-fired gas turbines. There is also a statement on the work being done under the supervision of Professor Sarjant by the Department of Fuel Technology of the University of Sheffield, on smoke abatement in metallurgical furnaces. This says :

"As a result of the investigations it is tentatively concluded that for certain types of heating the best atmosphere for minimizing scaling and decarburization is one which is slightly oxidizing, i.e., with about 3 per cent. of excess oxygen, which tends to counteract the influence of the sulphur and the hydrogen of the coal used. It would seem, therefore, that if coal-fired furnaces could be operated within this tolerance, the best conditions would be attained and the smoke problem considerably reduced."



Mr. Gerald Nabarro, M.P., has produced his own national fuel and power policy in a stimulating and closely-reasoned pamphlet, **Ten Steps to Power** (St. Catherine's Press, London, pp. 72, 3s.). It is difficult to summarize the ten main steps, or the 42 recommendations of which they are built, but we may quote his final conclusions on research and advisory services: (i) Consolidation of existing official, quasi-official and departmental

research for coal, gas, electricity and all other forms of fuel and power, except oil; the consolidation to lead to the creation of a Central Fuel and Power Research Board. (ii) Consolidation of existing advisory and consultative services into a Central Fuel and Power Advisory Service, with Industrial and Domestic Divisions; again to deal with coal, gas, electricity and all other forms of fuel and power except oil. (iii) The existing Fuel Efficiency Department of the Ministry of Fuel and Power to be absorbed into the Central Fuel and Power Advisory Service.

And also his recommendations on capital investment and co-ordination: (i) A White Paper to be published enunciating the National Fuel and Power Policy, and presented to both Houses of Parliament. (ii) Supporting legislation, as required to enact the White Paper proposals. (iii) A National Fuel and Power Trust to carry the policy into practical effect, deal with apportionment of capital investment, co-ordination of development and sales policy, and the maximum conservation of national coal, heat, light and power resources.

Mr. Nabarro has some pertinent things to say about smoke abatement and urges: (i) increasing the production and use of smokeless fuels, (ii) strengthening the powers of the local authorities by legislative action. He ends this section by saying:

"All strength to that admirable body 'The National Smoke Abatement Society' and a few isolated Members of Parliament in their lone battle in this vital matter, often against ignorance and prejudice. But they deserve and must have the support of Government within the framework of a National Fuel and Power Policy."



The Manufacturing Chemists' Association Inc., of the United States, has

published a series of pamphlets on air pollution abatement as related to the chemical and allied products industries. These have the general title **Air Pollution Abatement Manual** (M.C.A., 246, Woodward Building, 15th and H Streets, N.W., Washington 5, D.C., prices range from 15 to 60 cents each part). Twelve chapters have been planned and their scope can be indicated by listing their subjects: 1, Preface and Outline; 2, Introduction; 3, Terminology and Selected Data; 4, Community Relations; 5, Legislative Requirements; 6, Physiological Effects; 7, Sampling Procedures and Measuring Equipment; 8, Analytical Methods; 9, Meteorology of Air Pollution; 10, Dust and Mist Collection; 11, Gas and Vapour Abatement; 12, Evaluation of Data; 13, Bibliography.

The Manual is a publication of much interest and importance. Naturally, it views the problems from the point of view of the manufacturer, and in doing so reflects the concern that is being felt in the U.S.A. about air pollution and the awareness by industry of the need for preventive measures both as a social requirement and for the sake of good public relations.



Also from the U.S.A. comes a more specialized publication in the form of a Meteorological Monograph on **Atmospheric Pollution: A Group of Contributions** by various authors. (American Meteorological Society, 3, Joy Street, Boston 8, Mass., pp. 55, \$4.50). This quarto volume contains a series of thirteen papers, most of which were originally read at a symposium of the Society in 1950. They range from more general considerations of the subject to those specifically related to meteorology, climate, micrometeorology, turbulence and diffusion. An important source of information for those concerned with the scientific study of air pollution.

Correspondence

SMOKELESS FUEL IN BRITAIN

The Editor,

Smokeless Air

Sir,—I would join issue with Dr. Foxwell on two points in his very interesting article.

1. Dr. Foxwell says "public expression has been given to" reasons why electricity under present economic conditions should not be used for space heating. Public *expression* of opinion is not necessarily an expression of what is best for the nation as a whole. It depends upon what portion of the public is concerned and what their special interests are. If a section of the community felt their interests were being affected by competition they might rally round those who were concerned in their well-being and use all the political pressure and publicity possible to maintain their importance. This, however, would only represent the feelings of a section of the community. I do not think we should take too much notice of public expression unless all sections of the public—men and women—are included.

2. Dr. Foxwell makes the usual mistake in comparing fuel used by the power stations with coal used for gas making or on the domestic grate. It should by now be well known that, unlike the coal used for gas making or on the domestic grate, the slack burned under the power station boilers is unsuitable for export. This being so, except by using imported oil, the only way we can release exportable coal for export is to use electricity in our homes now.

Cooking and water heating by electricity is also "ideal" and contrary to Dr. Foxwell's statement help to level out the electrical load factor.

Yours, etc.,

R. E. GAMLEN.

Brighton.

THE DIVISIONS

East Midlands

A meeting of the East Midlands Division, attended by over 60 members was held at Lincoln on April 17th, beginning in the morning with a visit to the cathedral. Unfortunately Mr. Robert S. Godfrey, Surveyor and Clerk of the Works, was ill, and could not give the talk and demonstration of the effects of air pollution on the fabric of the cathedral that had been arranged. He is a recognized authority on this subject. However, members enjoyed the inspection of the building and the strenuous climb to the top of the main tower, from which they had a remarkable view of the city and the broad green acres of Lincolnshire—with very little smoke to obscure it. Incidentally, our frontispiece photograph in this issue was taken on this occasion.



Some of the East Midlands members on the top of Lincoln Cathedral tower. (Outside left, Mr. Alfred Wade, Hon. Secretary; outside right, Mr. T. Henry Turner)

Members were entertained to lunch by the Rt. Worshipful the Mayor of Lincoln, Councillor T. F. Taylor, J.P., who was accompanied by the Sheriff of the City. In the afternoon, in the ancient Guildhall, an address was given on "Damage to Structures by Atmospheric Pollution" by Mr. T. Henry Turner, who is Superintendent of the Metallurgy Division of the Railway Executive Research Department, and as an individual member of the Society was Chairman of the Yorkshire Division until he left that area. A report of Mr. Turner's address will be included in our next issue.

A very pleasant and instructive day.

West Midlands

The West Midlands Division met at Stoke-on-Trent, some 70 strong, on April 29th for a meeting and a visit to the British Ceramic Research Laboratories.

The morning meeting, under the chairmanship of Alderman G. J. Timmis a Vice-President of the Society, was held in the Hanley Town Hall. Mr. Farquharson, Hon. Secretary, gave a report, and a statement on the Society's activities generally

was made by Mr. Marsh. Then followed an address by Mr. Eric Bellingham, Director General of the Coal Utilization Council, entitled "Coal Utilization and Smoke Abatement," but which was rather a racy and forceful statement of C.U.C. policy and views—and as such was bluntly criticized by Mr. Duguid, the Executive Council Chairman. Mr. Duguid expressed the thanks of the meeting for his hospitality to the Lord Mayor of Stoke-on-Trent, Alderman H. Barks, at the enjoyable civic luncheon that followed.

The visit to the British Ceramic Research Laboratories in the afternoon was a memorable occasion, not only for the opportunity of inspecting the important work in progress in this new and well-appointed building, but also for hearing its Director, Dr. A. T. Green, give a talk about their work and its purposes in a way that combined humour, plain commonsense, and shrewd philosophy in a delightfully inimitable way.

North West

The annual general meeting of the North West Division was held in Manchester on May 15th, and was noteworthy as being the first meeting of the Society to take place in a smokeless zone. There was an excellent attendance of nearly 200 members and representatives to hear an address by Dr. Albert Parker, Director of the Fuel Research Station, on "Domestic Heating—Efficiency and Smoke Abatement." Among the matters discussed by Dr. Parker were the new types of domestic appliance, the methods by which they are tested at Greenwich, and the problems of smokeless fuel supply.

Scottish

Perth was the meeting place for the two-day annual conference of the Scottish Division on May 22nd and 23rd. Perth is truly a fair city, and with its generous open spaces and playing fields along the banks of the Tay, it is one of the pleasantest places in which a conference could be held. The meetings were held in the lecture hall of the city's attractive art gallery.

On the Thursday morning—or, we should say, forenoon—papers were read by Mr. Magnus Herd, Glasgow city analyst, on "The Evaluation of Atmospheric Pollution Records," and by Mrs. O. M. Willis, of the Scottish section of the Women's Advisory Council for Solid Fuel, on "New Hearths for Old." Both were excellent and useful contributions. On Friday morning Mr. William Short, Ministry of Fuel and Power, gave a paper on the Ministry's "Mobile Testing Unit in Industry"—a subject of importance that should receive more publicity. It is hoped to publish parts of this paper in the next issue. Then came a comprehensive review of the effects of polluted air from the medical viewpoint, "The Menace of Polluted Air," by Dr. Stuart I. A. Laidlaw, Medical Officer of Health for Glasgow. Finally, on Friday afternoon, a paper on the present position of "Smokeless Zones" was given by Mr. Arnold Marsh.

Dr. Laidlaw's paper has been printed as a booklet by the Glasgow Health and Welfare Committee. The Society hopes to arrange for copies to be obtained for sale at about 2s. each. For members wishing to have an up-to-date and critical survey of the health aspects of air pollution, which includes a consideration of the question of lung cancer, Dr. Laidlaw's paper can be recommended.

The smokeless zones paper is also being printed in pamphlet form to take the place of an existing pamphlet that is now very much out-of-date. The considerable interest in smokeless zones raised by the Manchester zone has brought many inquiries to the Society, and the review has already proved useful in giving the information needed.

On the first day of the conference the delegates were entertained to lunch by the Perth City Council, while on the second day the Division itself was host at lunch. Finally, mention must be made of a most interesting visit made on the Thursday afternoon to the Pitlochry dam and hydro-electric station.

The generation of electricity by water power, without any contamination of the atmosphere whatsoever, is a matter of particular fascination and hope to the air pollution enthusiast, and makes one wish that our country had a dozen areas like the Scottish highlands. On this occasion, however, interest seemed to be divided between the magnificent new dam and generating plant, and the salmon leap that has been constructed alongside. Here, a long line of ascending tanks, or basins, with the river water flowing down from one to another, provides a staircase by which, step by step, the salmon can ascend. One or two tanks are illuminated and through glass walls one can watch the great fish swimming round before finding and forcing their way up through the connecting pipe to the tank above. A smoke abatement conference can have its unusual and diverting aspects!

Pollution Problems in the Iron and Steel Industry

THE West Midlands Joint Advisory Council for the Abatement of Smoke and Atmospheric Pollution met at Bilston on March 6th, when a visit was made to the iron and steel works of Stewart and Lloyds. A talk on their problems was given by Mr. W. M. Larke, managing director.

After stating that in years gone by the Company and the Bilston Corporation had carried out some joint investigational work into atmospheric pollution in the district, Mr. Larke went on to point out that 46 per cent. of the raw materials, by weight, used in making a ton of pig iron, consisted of air, and that essentially the problems of the heavy iron and steel industry, with regard to atmospheric pollution, were great because they were nearly all combustion problems.

So far as the blast furnace plant is concerned, this is the principal offender, and under normal operation, it was pointed out the gas is cleaned and used for other purposes, but with the best will in the world, blast furnaces are at times difficult to control, with the result that adequate safety precautions have to be taken by the provision of bleeders situated as near to the top of the furnace as it is possible to get them.

Gas cleaning is carried out down to .008 grains per cubic foot, and the clean gas used for various forms of power generation. The provision of gas holders is highly essential to balance the rates of flow, but they can do little else because of the very large volumes of gas generated. A furnace producing 4,000 tons of pig iron per week produces, in fact, approximately 3,600,000 cubic feet of gas per hour, so that a 1,000,000 cubic feet gas-holder could only cover a period of a quarter of an hour.

With regard to the open hearth plant, it was pointed out that in order to reach the necessary temperatures it is essential for the furnaces to be of the regenerative type, because no adequate recuperators have yet been devised. This, therefore, means that the furnace, through its alternating direction in flow, cannot have ideal combustion, but that nevertheless very good combustion conditions are

achieved with CO₂ values of over 15 per cent.

Regarding the problem of the burning out of gas mains, many attempts have been made to mitigate the smoke nuisance, and a further one is to be tried out during the next 18 months by blowing the mains down frequently and endeavouring to discharge all the soot into an enclosed water carrying channel.

So far as the mills are concerned, it was emphasized that a non-oxidizing atmosphere is desired, and emphasis in the discussion was laid on the fact that this did not necessarily mean a heavily reducing atmosphere with its usual concomitant—a pall of black smoke from the furnace chimney. The great thing to be avoided was a sticky deep-seated scale. So long as the scale is flaky it will break off during the rolling operation.

With regard to the oxy-acetylene de-surfacing machine, it was noted that the majority of the material removed is carried away by water and that which is airborne is in fact deposited in the cyclones, with the exception of particles of the order of size of one microhm. Investigations into dealing with this problem, because of the bad psychological effect of the harmless orange coloured exhaust, have been carried out with the British Iron and Steel Research Association, and emphasis was laid on the vast amount of joint research work carried out by the individual companies and the British Iron and Steel Research Association into this and other technical problems affecting the steel industry, and it was pointed out that even in our present state of knowledge, something of the order of 20 per cent. of the capital cost of a plant is devoted to gas cleaning and into atmospheric pollution equipment. It is not pretended that this is done entirely from the atmospheric pollution point of view, because obviously clean gas has many applications where the use of dirty gas would not be possible.

It was stressed that we had nowhere near reached finality on the subject, although we thought we knew some of the answers, and we are doing our best to make the heavy steel industry a "good neighbour."



Going—Gone!

In our Summer, 1941, issue we published an article under the title “Greenwich Observatory Must Go,” in which, in an interview, the Astronomer-Royal explained why plans were being made to move the Observatory from its historic site to a smoke-free district. The article was illustrated by the above photograph, with the General Wolfe statue in the foreground. Below is the scene today. London’s famous observatory has been driven out because of the obscuring smoke pall and the damage done by grit and acid to its instruments.



Grit and Dust Collection

By

J. C. Cleeves

From a Paper read at a Joint Meeting of the North-West Division, N.S.A.S., and the North-West Section, Institute of Fuel, at Manchester, October 17th, 1951.

IT can well be stated that the ideal dust collector, embodying the essentials of : high efficiency ; low resistance to gas flow; small space requirements; small initial outlay; and low operating and maintenance costs, does not exist. The design of a collector for a particular application, therefore, calls for a compromise, it being recognized that the best in one case is not necessarily suitable under other conditions.

The improbability of "something for nothing" is, perhaps, more true in connection with dust collectors than anything else, as usually the initial cost increases heavily with the increase of efficiency required.

The initial cost increases out of all proportion with efficiencies of over 95 per cent. If a volume of 20,000 c.f.m. is assumed as being representative of the volume of flue-gas from a medium-sized industrial boiler plant, the approximate cost of a collector giving an efficiency of 92 per cent would be in the neighbourhood of £1,500, but if an efficiency of 96 per cent was required, then the initial cost would rise to approximately £6,500.

There are five types of dust collectors which are in normal commercial use, namely:

- (a) Settling chambers.
- (b) Those depending on impingement, to which may be allied gas washers.
- (c) Filters.
- (d) Electrostatic precipitators.
- (e) Collectors operating by centrifugal action.

each of which should be considered separately.

The Settling Chamber

This, as it implies by its name, consists of a chamber or duct of considerably larger cross-sectional area than the inlet duct. Owing to the reduction of velocity of the gases in this "chamber," and the consequent reduction in the velocity of the dust particles in suspension, the larger particles fall out of the gas stream by their own inertia.

The separation is often assisted by the inclusion of baffles in the chamber, which cause a sudden diversion from the straight flow of gas. Normally its efficiency is not high enough for modern boiler plant requirements, and practically speaking, its use can be ruled out, although it is sometimes used as a primary cleaner for blast furnace gas, when the larger space occupied is of less importance, relative to the bulk of the rest of the installation.

Advantages: Low resistance to gas flow.

Disadvantages: Large amount of space occupied; low efficiency, unless the velocity through the chamber is reduced considerably, with the consequent rapid proportional increase in size.

There are, however, types of collectors designed for use on small boiler plants, which operate on the combined principles of the settling chamber and impingement. This collector is normally situated at the base of the steel stack, immediately above the boiler.

The dust-laden gases, on entering the collector from the stack, not only lose velocity owing to the greater cross-sectional area of the collector, but are also deflected outwards and slightly downwards by three inverted cones sited along the axis of the stack and collector.

The particles not only settle out of the gas stream due to the loss in velocity, but the settlement is assisted by the combined effect of impingement and the downwards deflection caused by the cones. The dust falls on to a sloping plate, and thence down the dust pipe to a conveniently situated storage hopper.

This type has given very satisfactory results on small boiler plants operating on low-grade fuels, such as coke-breeze.

Advantages: Low in initial cost; easily installed; no floor-space requirements, being fitted in the stack itself; practically no maintenance required; low resistance to draught; satisfactory efficiency over a reasonable range of particle sizes.

Disadvantages: Only suitable for small boiler plants; not suitable for high stack

velocities, or dust of very low specific gravity and large sail area; normally can only be fitted to steel stacks.

Impingement

This can be of the wet or dry type. The former generally consists of a water spray, or wet surface where the individual particle is either enclosed in a film of water by impingement on a curtain of spray, the weight of the particle being thus increased by the weight of the film of water enclosing it, and so falling out of the gas stream, or, alternatively, it adheres to the water-covered surface and is removed by the flow of water over the surface. This type of collector can be very efficient, particularly with regard to the smaller particles, but calls for a substantial supply of water, recirculating pumps, and settlement tanks. Furthermore, the presence of SO_2 in the gases results in the formation of sulphuric acid, even though in diluted form, with the consequent danger of corrosion.

Dry impingement, on the other hand, is not so effective, depending as it usually does, on the sudden diversion of the particles into a secondary air stream, where they are allowed to settle out, or are passed through a secondary collector for final removal.

A typical "wet impingement" collector consists of a series of vertical elements or tubes, which are covered externally by a film of water delivered through nozzles fitted to the base of the header which forms the top of the collector. Successive rows of tubes (there are usually between 5 and 20 rows) are staggered, so that the dust-laden gases on their passage through the collector, are diverted from a straight path. The dust impinges on the water-covered tubes, where it is retained and carried down the tubes by the flow of water, to the sludge trough at the bottom of the collector. The sludge trough forms a water seal against the free passage of the gases below the tube level.

The water and sludge are taken from the trough to settling tanks, whence the water is recirculated through the collector, the amount lost being made up by fresh water, the flow of which is controlled by automatic valves.

The drop in efficiency between full load and quarter load is slight, being roughly 4 to 6 per cent.

Advantages: High efficiency; low pressure drop across the collector; reduction in soluble fume emitted from the stack, due to its absorption by the water.

Disadvantages: Possibility of corrosion of the elements, fan and other steelwork following, due to SO_2 , and the formation of sulphuric acid; water consumption; space required for settling tanks; moving machinery required, e.g., re-circulating pumps, automatic valves, etc.

Electrostatic Precipitators

These are probably the most efficient form of collector at present available, particularly with regard to the very small particles. They will, in fact, precipitate particles in the fume range, and are sometimes used for this purpose when the fume is non-explosive. There is, however, a probability that the large particles of 150-300 microns settle out of the gas stream by their own inertia, owing to the very low velocity (normally 3-5 ft./sec.) through the precipitator, although their removal would be assisted by the electrostatic influence.

The principle of operation is that the dust-laden gas is passed between two electrodes, one of which is earthed, and the other charged to a high potential. The high potential difference sets up a corona discharge, which is responsible for a stream of ions being released from the charged electrode to the earthed electrode. These ions, in their passage across the gas stream, collide with, and attach themselves to, the dust particles in suspension in the gas stream, and carry them to the receiving or earthed electrode, where the dust adheres and gives up its electrostatic charge. The dust agglomerates are removed from the receiving electrode by rapping or vibrating the latter.

The very high initial cost, however, rarely justifies its use with ordinary industrial plants, particularly as it is possible to obtain an efficiency very near to that of the precipitator by other methods.

Precipitation is dependent on a high voltage (14-75 k.v.) d.c. unidirectional supply, and shut-downs may occur due to heavy overloading, causing back ionisation and flash-overs, or to the breakage of one of the discharge electrodes due to corrosion or oscillation, and a consequent direct earth. The former may occur during soot-blowing periods, when the dust concentration in the gases becomes very high, and for this reason, mechanical collectors are often installed before the electrostatic precipitator, leaving it to deal with the ultra-small particles, some of which are bound to pass through the pre-collector.

Chiefly owing to its large size and high initial cost, the electrostatic precipitator is normally only used in power stations or in commercial plants where the recovery value of the dust is high enough to justify the high initial outlay required.

Advantages: High efficiency, particularly with regard to small particle sizes (97.5 per cent quoted); low resistance to gas flow ($\frac{1}{2}$ to $\frac{3}{4}$ in. w.g.).

Disadvantages: Very high initial cost; large space requirements; efficiency adversely affected by the high carbon content of grits. If this exceeds 20 per cent the gas velocity through the precipitator must be reduced even as low as $2\frac{1}{2}$ ft./sec., entailing an increase in size, and, therefore, cost; liability to overloading, and, therefore, "flashovers"; possibility of shut-down owing to the breakage of an electrode or subsidiary electrical gear.

Filters

Filters, which depend upon the medium having pores smaller than the particles to be removed from the gas stream, are seldom, if ever, used for the extraction of dust from flue gases, though they are very effective for processes operating at low temperatures around atmospheric conditions.

Their liability to build-up (with consequent increase in resistance; the difficulty of cleaning them, and the space occupied, make them unsuitable for the purpose under discussion as well as the fact that they may have to stand up to constant temperatures of 700°F. and more.

Centrifugal or Cyclonic Collectors

Collectors operating on this principle may be considered under three sub-headings, namely:

- (a) The conventional cyclone.
- (b) Combined induced draught fans and dust collectors.
- (c) The multi-tubular or multi-cyclone collector.

in all of which the application of centrifugal force is used for the separation of dust from the gas stream.

The Conventional Cyclone

The dust-laden gases are led into the periphery of the cyclone either under pressure or suction. In the cyclone they rotate at relatively high velocity, the dust being thrown out by centrifugal force to the inner surface of the casing of the cyclone, whence it slides down the cone to the discharge at the bottom. At a predetermined point which varies according to the pressure drop across the

cyclone, but which normally is approximately midway between the bottom of the gas inlet and the cone outlet, the rotating gases turn upwards, and are discharged from a centrally situated outlet at the top of the cyclone. The normal type of cyclone of say 3 ft. and more diameter, is not very efficient below a particle size of 30-40 microns, though it offers a reasonably cheap solution for coarse grit extraction problems.

A cyclone to handle 5,000 c.f.m. at a pressure drop of 2 in. w.g. is approximately 4 ft. 6 in. in diameter, and, therefore, where a large volume of gas has to be handled it would be necessary to have a battery of cyclones, which, together with the associated ducting, would take up a considerable amount of space.

When the gases are carrying abrasive dusts, such as flue gas dust and grits, considerable wear takes place at the bottom of the cyclone cone. The collection efficiency is dependent on the centrifugal force exerted on the dust particles by the speed of rotation of the gases in the cyclone— MV_2/R —and this speed is obviously related to the pressure drop across the cyclone, which is usually between 1 and $2\frac{1}{2}$ in. w.g. Increased velocity (or pressure drop) which increases the efficiency, causes the apex of the upward vortex or spiral of dust free gases, to descend to a lower point towards the dust outlet of the cone.

This vortex eventually contacts the cone, which is covered with the precipitated dust, and the rapidly rotating concentration of the dust forms the equivalent of a cutting edge, which will wear through an ordinary mild steel cone in a remarkably short time. It is, therefore, generally advisable to fit a cast iron cone when the cyclone is operating under similar conditions.

A gas seal must be provided at the dust outlet, and some form of constant discharge arranged, as if the accumulated dust is allowed to build up in the cone, it will be picked up by the clean gas vortex, and carried up through the cyclone outlet.

Advantages: Cheap to install; reasonably efficient for coarse grits (75 to 80 per cent); reasonably low operating resistance (1 to 2 in. w.g.).

Disadvantages: To handle the volume of gases from a medium-sized industrial boiler plant, and to maintain efficiency, more than one cyclone would be required; only efficient for coarse grits; liable to rather rapid wear, due to the comparatively high rotational velocity of the gases.

Combined Induced Draught Fans and Dust Collectors

This is, in effect, a two-stage collector, utilizing the induced draught fan (which would be necessary in any case to overcome the resistance of the cyclone) as a primary separator, and providing a collector with a higher overall efficiency than that of a conventional cyclone.

In the primary stage, the particles are thrown to the periphery of the fan casing by centrifugal force set up by the fan impeller. The scroll of the fan casing is continued beyond the normal 360° by a further 200° . Practically all the dust particles are thus concentrated in a thin layer at the outer periphery of the fan, leaving the inner portion of the cross-section practically dust free.

Just before the actual fan discharge, this layer of heavily dust-laden gas (about 10-15 per cent of the total volume) is skimmed off by means of an adjustable skimming damper, and is led to the inlet of a conventional type cyclone, the remaining 85-90 per cent of practically dust-free gas being discharged from the fan in the normal way. The extension of the scroll prevents interference by turbulent gas from the impeller on the dust-laden layer on the outer periphery.

The 10-15 per cent of gas which passes through the cyclone is led from the cyclone outlet, back to the fan inlet, so that any dust not removed by the cyclone is re-introduced into the circuit, thus building up the dust burden at the fan inlet, with the consequent increase of efficiency of the whole system.

This type of collector is particularly suitable for medium-sized boiler plants of three Lancashire boilers or the equivalent burning up to say 200 tons per week, the firing of which is normally manual or by mechanical stokers.

An efficiency of 70 per cent at 30 microns, rising to well over 90 per cent at 100 microns, and over, can be anticipated from this collector.

Advantages: Combined duties of an induced draught fan and dust collector; two-stage collection; reasonably high efficiency (85 per cent average); medium cost.

Disadvantages: The impeller of the fan is operating in dust-laden gas, and, therefore, wear must occur on the casing etc. Wearing plates (which are cheap and easily replaceable) are usually fitted round the fan scroll where the major portion of the wear occurs, to compensate for this; slight extra h.p. required over and above

that of the normal induced draught fan, to overcome the resistance of the cyclone; limited capacity.

The Multi-Tubular or Multi-Cyclone type of Collector

Where the size of the boiler plant is such that the combined induced draught fan and dust collector would not be suitable owing to the large volume of gases to be handled, or where pulverized fuel firing is in operation, the multi-tubular or multi-cyclone type of collector offers the most satisfactory solution, particularly when the primary requirements of a dust collector are remembered.

It is well known that the smaller the diameter of the cyclone body, the higher is the centrifugal force exerted on the dust particles, and this fact naturally led to the development of this type of collector.

The tubular collector consists of a number of tubes of 6 in. diameter or less (each of which is, in effect, a cyclone) operating in parallel, and mounted in a common casing into which the dust-laden gases are introduced. The tubes are mounted between two tube-plates, the top one of which forms the bottom of the cleaned gas outlet duct, and the bottom one, the top of the dust receiving hopper, into which the tubes discharge the precipitated dust.

The gas inlet to each tube is in the form of a long narrow slot, running parallel to the axis of the tube. This slot affords a tangential entry for the gases to the inner periphery of the tube, and ensures that the dust particles have the minimum distance to travel before coming into contact with the inner surface of the tube. Equal gas distribution to individual tubes is effected by sloping the top tube-plate downwards from the inlet towards the back of the collector, so that the velocity of the incoming gases is maintained at a constant throughout the collector casing from the front to the back.

A similar type of collector, also employing a multiplicity of tubes, has vanes at the inlet to the tubes radially disposed round the axis. These vanes direct the gas at an angle to the path of the entry, and impart the "swirl" or radial velocity to it. The dust is thrown to the periphery of the tube, and the outer dust-laden layer is bled off by means of a secondary fan for final removal by a conventional type cyclone or some other type of collector, the cleaned gases passing through the outlet tube sited axially at the end of the main collector tube remote from the inlet.

It has been found, however, that with

this type of tube, there is a possibility of a proportion of the dust particles bouncing back from the tube walls, and being re-entrained with the gas stream, with a consequent adverse affect on the efficiency of collection.

In the case of relatively coarse dusts, tubes with two inlets are used in order to reduce the pressure drop or resistance across the collector, to a minimum. Where, however, a fine dust is to be collected, such a pulverized fuel-fired dust, either a 6 in. diameter tube with a single inlet, and therefore, a slightly lower capacity, would be used, or a larger number of double inlet 3 in. diameter tubes would be installed.

If for any reason, such as firing conditions, or the type of fuel used, it is desirable to separate the coarse grits from the fines in order to re-fire the former, effective separation is brought about by tilting the collector at an angle of 45° , and fitting a second (or decantation) hopper at the back of the collector in place of the normal back plates.

The large particles are carried through between the tubes by their own momentum, and are deposited in the decantation hopper, while the fines, which are still in suspension, travel with the gas into the tubes or cyclones, where they are removed and deposited in the other hopper.

The capacity of each tube (and, therefore, the collector) is calculated generally in accordance with the normal cyclone design laws, the pressure drop across the tube being proportional to the square of the volume. This means that the higher the permissible pressure drop across the collector, the fewer the number of tubes required, and, therefore, the lower the initial cost of the collector. The normal pressure drop at which this type of collector operates is from $1\frac{1}{4}$ in. to 3 in., depending on the particle size analysis of the dust to be handled, and the type of tube selected.

The dust collection efficiency varies slightly according to the pressure drop across the collector. This variation in efficiency is, practically speaking, only noticeable at particle sizes from 20 microns diameter downwards. This means that there is only a very slight decrease in efficiency from full load down to $\frac{1}{4}$ load. If it is desired to maintain optimum efficiency at all loads, this can be simply accomplished by isolating the necessary number of tubes by means of dampers (which may be manually or automatically operated), so that the pressure drop across

the number of tubes in circuit at low loads, is maintained at approximately the same figure as that at full or design load.

The increase in the dust concentration in the gases from the normal 2-4 grains per cubic ft. up to say 20-25 grains per cubic ft., actually results in a slight increase of collection efficiency. This is of particular interest when soot-blowing, when the dust concentration is considerably heavier than when the boiler is under normal operation.

It may be stated, therefore, that the collection efficiency varies remarkably little over the large range of gas volumes normally experienced with the fluctuation of load on industrial boiler plants.

The use of a multiplicity of tubes or cyclones of small diameter not only supplies a collector of high overall efficiency, but also provides a flexibility of arrangement which enables it to be designed to suit most site conditions. On large boiler plants these collectors are often sited in between the economizer and air heater, which gives an indication as to the small amount of space occupied and also their adaptability.

Tubular collectors of this type have been in operation for a considerable time, without showing any appreciable signs of wear, although the dust passing through them has been of a highly abrasive nature. The relatively low velocity of the gases in the tubes reduces wear to a minimum, it being normally only noticeable in the cast iron cone, which is readily replaceable, if required, at a slight cost.

Advantages: High efficiency over a wide load range (90-95 per cent); flexibility of arrangement and small space requirements; very low maintenance costs; reasonably economic with regard to fan h.p. ($1\frac{1}{4}$ to 3 in. w.g.); medium initial cost.

Disadvantages: For highest efficiencies, a slight increase in fan h.p. is required; rapid dropping off in efficiency at particle sizes below 5 microns diameter. This, however, almost only applies to pulverized fuel-fired plants; possibility of dust clogging in the tubes, if, for any reason, condensation occurs in the collector, or the dust in the flue gases is of an inherently sticky nature, due to the burning or other than normal fuels in the furnace.

An attempt has been made to consider the application of various types of dust collectors to the very important problem of elimination of dust and grit from the flue gases of industrial chimneys. Elaboration on the theory of principle of operation (which could easily supply the material for a separate paper for each type

of collector) has been purposely avoided for the sake of brevity, and there are, perhaps other types of collectors which have been omitted from the discussion.

The paper has, therefore, been confined to the practical considerations affecting the choice of a collector to suit the conditions experienced with the normal run of industrial plants.

By plotting a curve relating the initial cost of various types of collectors, and their efficiency, it immediately becomes apparent that the absolute maximum efficiency calls for an extremely heavy

increase in the initial cost of the equipment.

As the absolute maximum overall efficiency is only obtained by the retention of the extra 4 or 5 per cent in the particle range of 15 microns downwards, it is not normally necessary for industrial plants, owing to the extremely wide dispersal of these small particles. Although their retention is obviously desirable, the very high initial outlay required to effect this is such that there are very few commercial undertakings who could afford to install such equipment.

SMOKE PREVENTION ABSTRACTS

186. Comparison of Calcium and Barium Compounds as Extenders for Paint. (J. Oil and Colour Chemists Assn., January, 1952, **35**, 7-19). Report of a co-operative investigation by members of the Association to classify the position regarding the use of calcium compounds as extenders in interior paints and to collect data about the exposure conditions in various parts of the British Isles and elsewhere. Panels were exposed at sites classified as heavy and light industrial, marine, suburban, clean country, etc. Results are of interest from air pollution study viewpoint. Main conclusions are that the relative durability of a set of paints may vary widely in different localities and that the severity of an exposure site would appear to be determined more by the cleanliness of the atmosphere than by the amount of sunshine and rainfall.

187. Investigation of Whole-house Heating, Lant, F. C., and Weston, J. C. (J. Inst. Fuel, May, 1952, **25**, 109-114). Temperature, fuel consumption and expenditure for houses with various forms of whole-house heating are given and compared with data for conventional heating arrangements. The applicability of whole-house heating in this country is discussed in the light of experimental data obtained. It is concluded that tenants who are economically con-

strained cannot afford and therefore do not like whole-house heating. Of the remainder the majority are satisfied, but their satisfaction frequently depends on the addition of some form of radiant heating, usually an electric fire. Finally there are those who do not like convection heating for a wide variety of reasons other than economic ones.

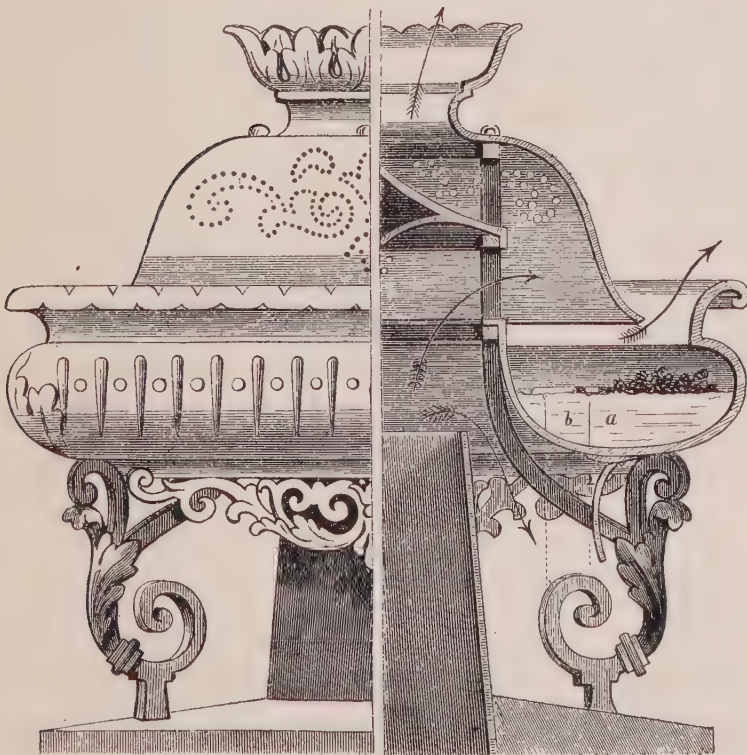
188. The Railways and Coal, Jarvis, R. G. (Paper to joint meeting of Inst. Fuel and Inst. Loco. Engrs., London, May 1st, 1952). The aim of British Railways is to keep the consumption of coal down to a practical minimum and this object is pursued from every angle. The recruitment and training of footplate staff and their subsequent instruction are designed to ensure as far as possible that the best methods of firing and driving are employed, and that coal is not wasted by unskilful handling of the locomotive. The steam locomotive, as a heat engine, has not a high thermal efficiency, but as an operating tool it has the advantage of consuming an indigenous fuel, coal, which even at present-day prices is still cheaper, on a heat-content basis, than imported oil. Attempts to improve the efficiency have not always met with conspicuous success, but have frequently added to the complication of the machine. Nevertheless, experiments are still being carried out

in the attempt to produce a steam locomotive with a higher thermal efficiency. Other forms of traction can and will ultimately be adopted, which will work at higher thermal efficiency. It is the policy of British Railways to pursue electrification, but the capital expenditure required for any wholesale scheme cannot be faced now or even in the foreseeable future. Moreover, the increased service which would be required to justify the outlay, would not permit any reduction in the total coal consumed. Coal would be saved by using diesel traction, and investigations and trials are afoot with this objective in view.

189. Control and Recovery of Dust and Fume in Industry, Ashman, R. (Paper to meeting of Inst. Mech. Engrs., London, May 2nd, 1952). The paper begins with reference to the various purposes and applications of dust control and recovery. The nature of dust and fume is then discussed. Consideration is given to the various methods of controlling dust and special attention is given to the design of local exhaust systems. Recovery equipment can be classified on the basis of the principle used, i.e., gravitational, iner-

tial and centrifugal separation, electrostatic precipitation, filtration, washing and ultrasonic agglomeration. Each of these main groups is considered and is followed by notes on the selection of equipment for specific duties. A substantial part of the paper deals with the prevention of, and protection from, the explosions and fires which are a serious hazard in many dust control and recovery installations. It is suggested that the introduction of some measure of standardization of design in this field would be a useful service to industry generally.

190. Stacks are Getting Taller, (Chem. Engrg News, New York, November, 1951). Describes the development of tall chimneys for dispersal of SO_2 in smelter flue gases and illustrates the new 611 ft. chimney of the El Paso plant of the American Smelting and Refining Co. Discusses the laws of dispersal from tall chimneys and of hot gases, and states that 1 lb. of SO_2 at air temperature from a chimney 10 ft. high will reach the ground in the same concentration as 6,000 lb. of SO_2 from a 500 ft. stack at 110°F . above air temperature.

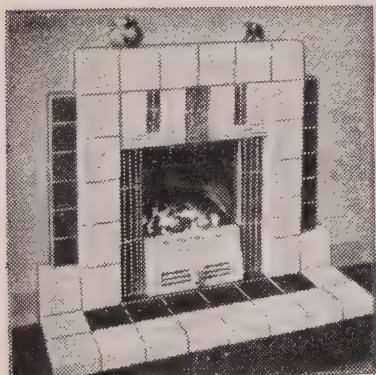


Tile Piece

Cut from the article on "The Vomitories of London" in our last issue because of lack of space, but too intriguing to waste, is this further ingenious device from the 1869 booklet by C. J. Richardson. He describes it thus: "In winter, when there is most smoke, there is most water, with little or no evaporation; by putting a capping to chimney-pots or funnels, and spreading out the lower edge, a considerable body of water could be collected, and the smoke projected over it would lose some portion of its soot, which could be floated away by a pipe."

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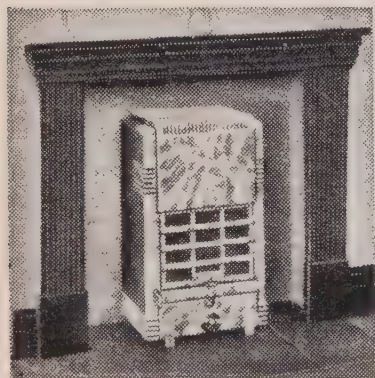
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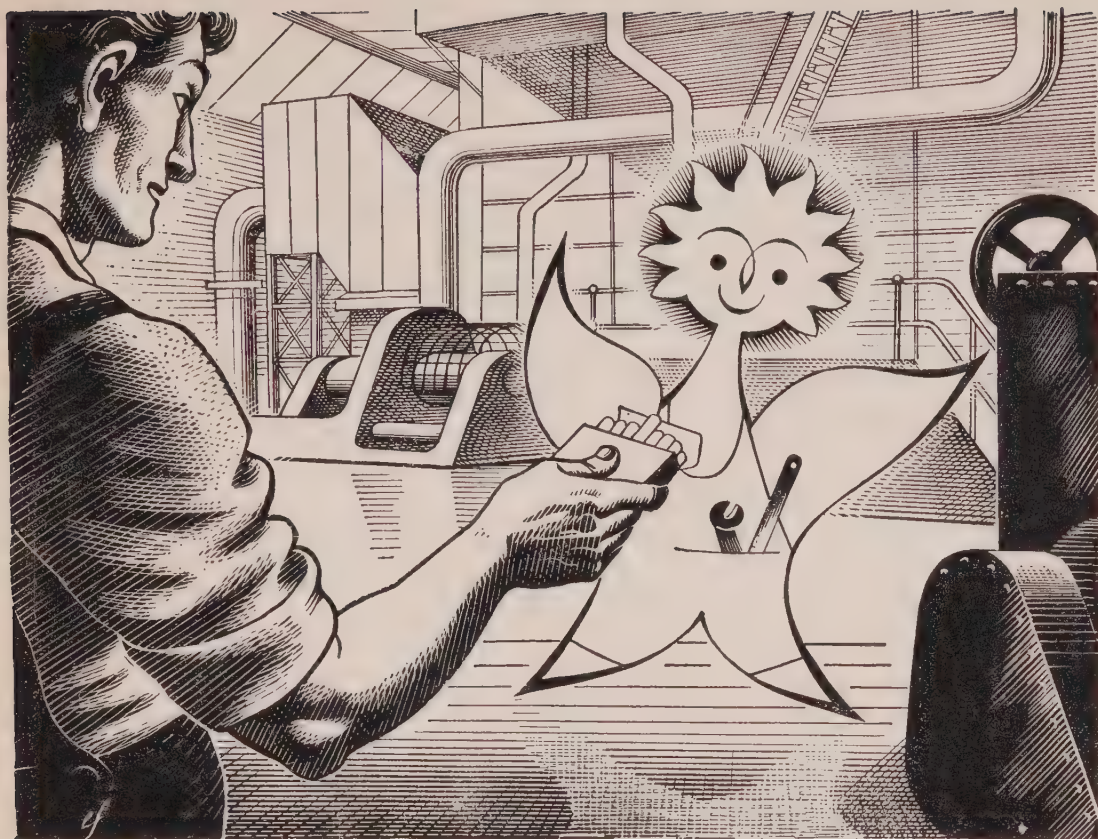
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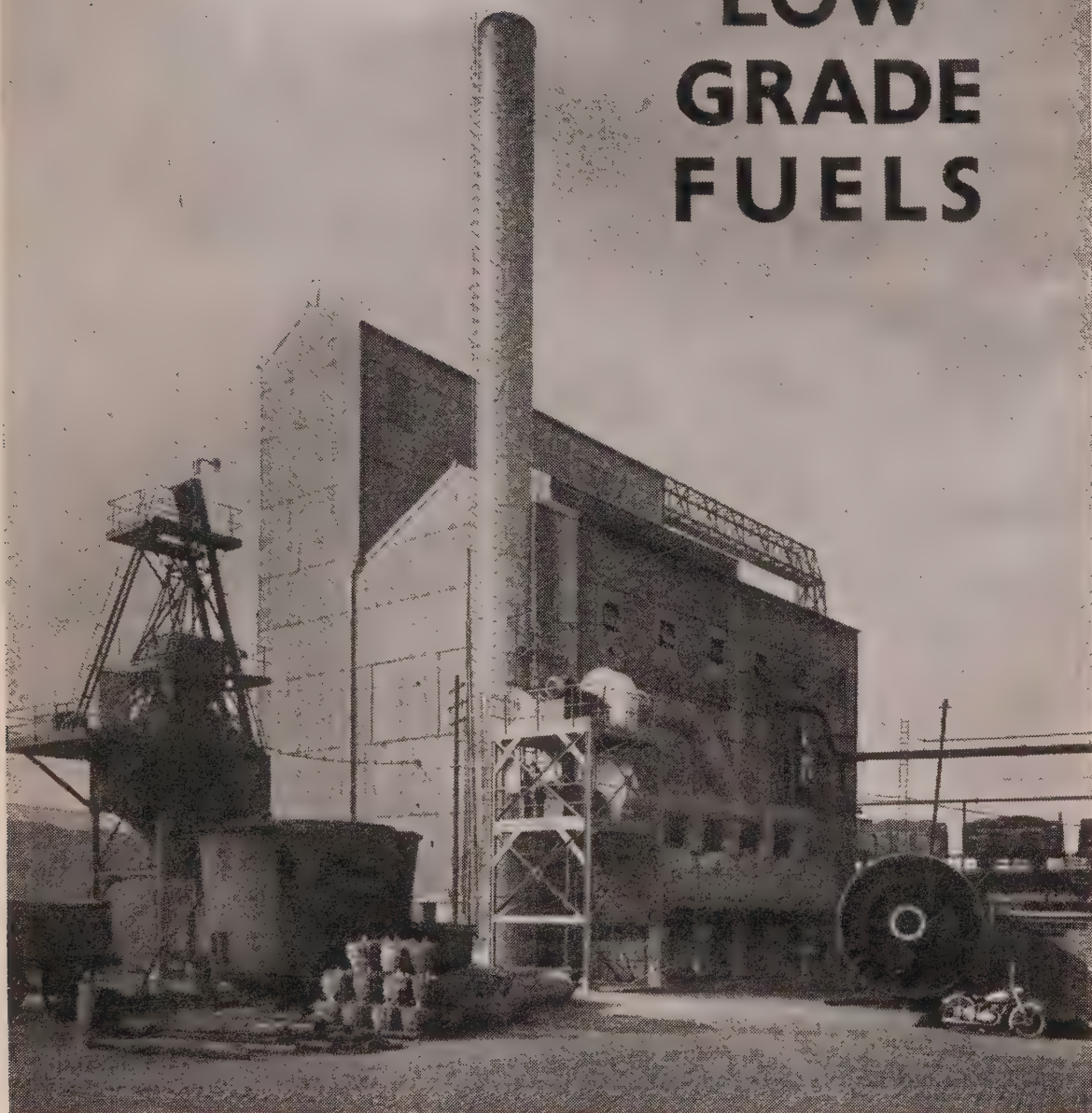
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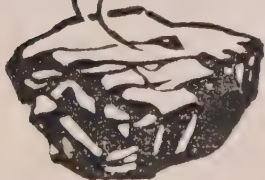
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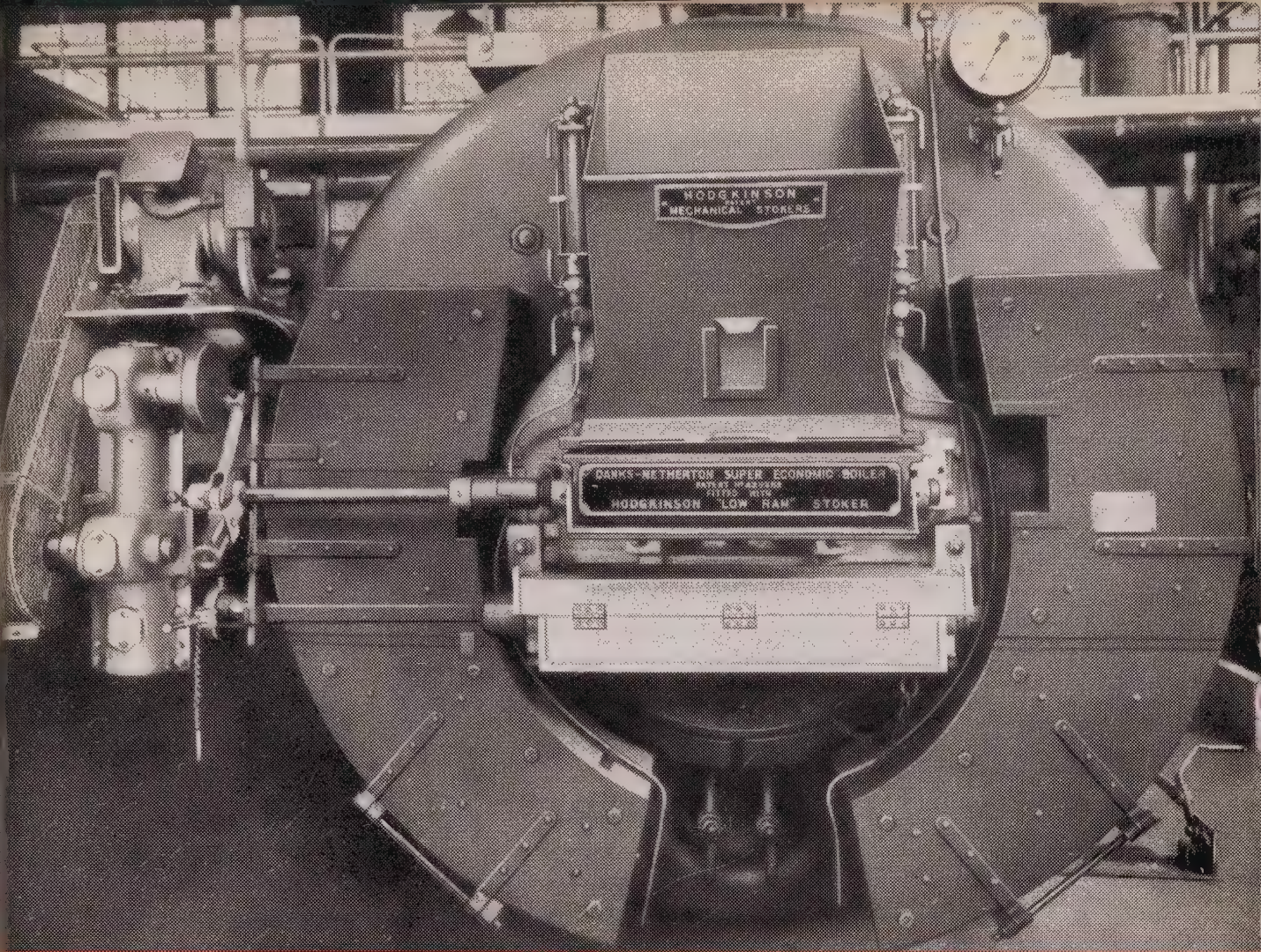
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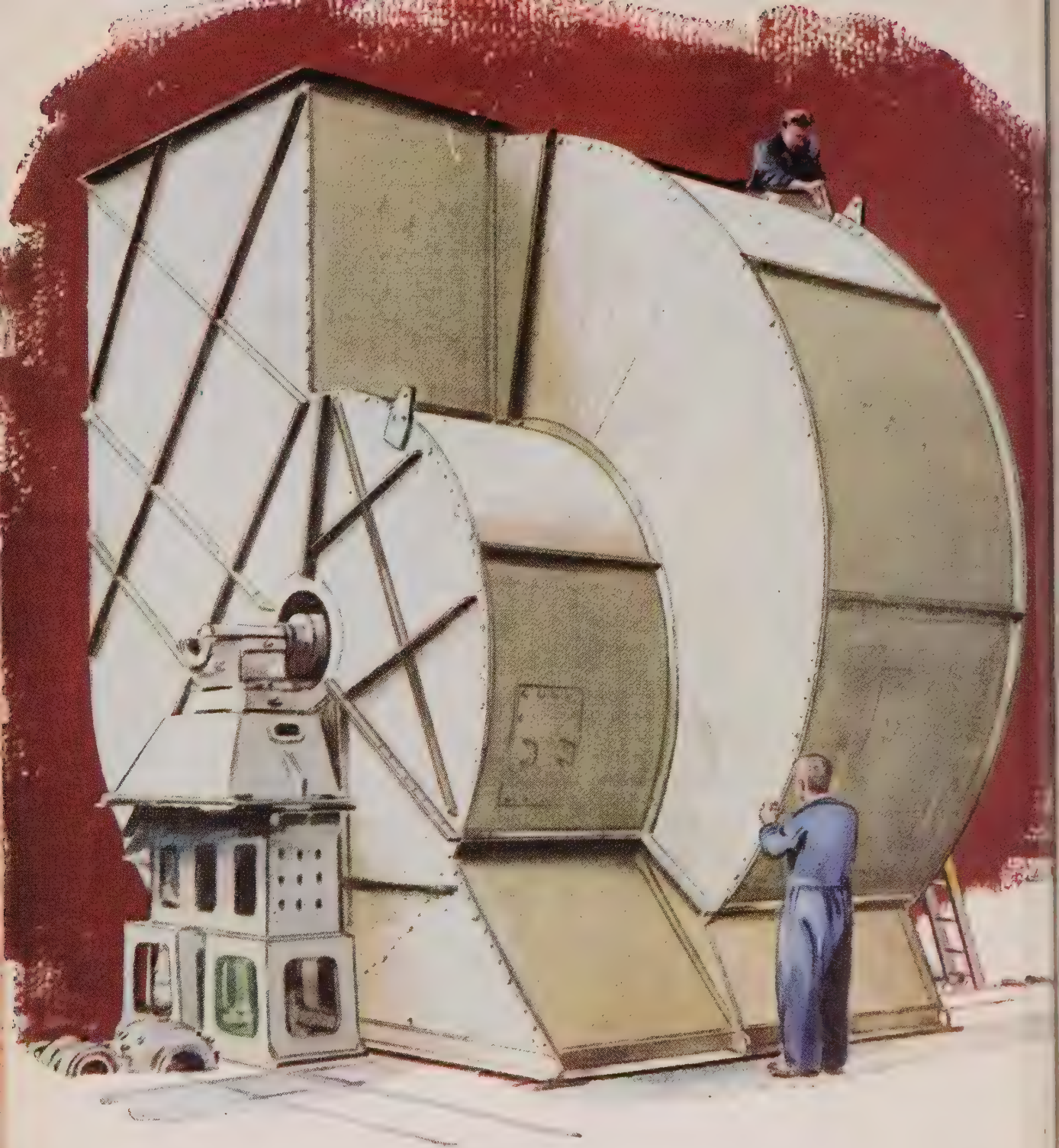


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